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BOOKS FOR THE COUNTRY.

PRICE ONE SHILLING.

SMALL FARMS,

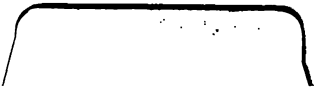
AND

HOW THEY OUGHT TO BE MANAGED.

BY

MARTIN DOYLE.

LONDON:
G. ROUTLEDGE & CO., FARRINGDON STREET;
AND 18, BEEKMAN STREET, NEW YORK.



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CARLISLE.

SMALL FARMS.

SMALL FARMS.

A Practical Treatise

INTENDED FOR

PERSONS INEXPERIENCED IN HUSBANDRY,

BUT

DESIROUS OF EMPLOYING TIME AND CAPITAL IN THE CULTIVATION OF THE SOIL.

BY

MARTIN DOYLE,

AUTHOR OF "HINTS TO THE SMALL FARMERS OF IRELAND," ETC. ETC.
AND EDITOR OF "THE ILLUSTRATED BOOK OF POULTRY."

The Fourth Thousand.

LONDON:
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INTRODUCTION.

THERE is, perhaps, no occupation, except that of a legislator, so frequently entered upon by persons deficient in the necessary information, as farming. To this cause, much more than to the vicissitudes of seasons, which affect all farmers alike, are to be assigned the disappointments and failures that not infrequently dishearten and disgust many who engage in agricultural pursuits. One who has been successful, or the reverse, in business, wishes to retire from the anxieties and cares of the city or the town, and settles down for the remainder of his days in the quiet of a country life. He looks into the *Times* or *Agricultural Gazette*, and sees the advertisements of farms, and making a selection of one that seems to be best suited to his circumstances, hurries off to view the advantages so glowingly described by the advertisement, and being satisfied after personal inspection, speedily comes to terms with the proprietor.

Let us suppose the late tradesman or professional practitioner, as the case may be, located with his family in this rural residence: he walks over the newly-acquired farm; there are neat hedge-rows dividing the fields, and these perhaps are well laid out—a great matter, doubtless, as a preliminary; but then comes the important question, How are these fields to be cultivated to the best advantage? Implements, such as ploughs, harrows, scufflers, drill-machines, &c., &c., are to be purchased; horses and cows, too, must be carefully selected. Now to do this well, it will be necessary to possess some knowledge of the principles upon which the implements are to work, and keen judgment at the horse and cattle fair, where there are always persons ready to practise upon the unwary and ignorant. These, to the inexperienced farmer, are difficulties, which lie as it were at the very threshold of his undertaking, and he must be prepared for many more. Some of his fields are stubble, some grass land, some were last under green crops,—what is to be done with each? If the former tenant has been negligent, there is no doubt a considerable share of weeds; and it is highly probable that a very inconsiderable share of manure has been employed: the grass land exhibits some goodly specimens of ragweed (no bad sign of the quality of the soil), stout enough to serve on occasion as a tethering-pin for confining a cow, —*for the ingenious will* find a use for everything; and *there is, too, a plentiful* crop of couch-grass luxuriating

through the stubble, looking so green and rank as to make the late citizen clap his hands and praise the fertility of his soil; and docks and thistles may be shedding their seeds to every wind that blows, and preparing employment for labourers next year. The new-comer sees all this; there is ample work before him, but how is he to go about doing it? New brooms, it is said, sweep clean; and so he determines to enter on thorough cleaning. This determination is very good, but it needs *system* to give it effect: the weeds, if pulled up, must not be thrown upon the earth to sprout again with the first shower of rain; some are to be gathered in heaps and carried to the manure-pit to rot and be made useful; others, such as couch, must be burnt, and rendered serviceable when reduced to ashes.

When this is done, as far as may be practicable at the beginning, there comes the management of the fields, the depth to which the land should be ploughed, and the preparation for cropping. The different grains are to be suited to the soils, and the best samples of each kind procured. Here a knowledge of agricultural chemistry and of vegetable physiology is necessary, and discrimination to select good seed; and such matters, it will be allowed, demand careful study.

When all this, however, has been done, the proper rotations fixed, and the different fields sown in due seasons, there follows the treatment of the growing crops, *rolling*, weeding, hoeing, scuffling, moulding, &c.; and,

lastly, the harvest, the time for cutting and gathering in, stacking, thatching, thrashing, winnowing, &c. How many nice calculations are required in all these things! what accuracy and care! If the corn be cut too green, the grain will be shrivelled and deteriorated; if too ripe, it will be in a great measure lost; if not dry-saved, the sheaves will mould in the stack, and there is danger of heating. If hay be so dried before it be put together in rick as to have no power of self-fermentation, its quality is inferior, and its money-value consequently diminished; if it be gathered in too moist a state, it heats violently, and at length bursts into a blaze and is wholly consumed, causing, it may be, the conflagration of other farm produce, and all the buildings on the premises besides.

There is the live stock, too,—horses, cows, calves, sheep, lambs, pigs, and poultry. The number of these must correspond with the capacity of the farm, neither too few nor too many; and much judgment is necessary in selecting and purchasing them. Now, the unskilled farmer will be at fault in all these respects; wherever he looks, the subjects which he ought to know increase upon him. How is he to acquaint himself with each? He seeks information from books,—but one is too diffuse, the seasons pass while he is studying it; another is too condensed, it leaves him in ignorance of too much; he wants the fullest information in the readiest form. To supply this want *to those who* are not professed farmers—for to these I do *not presume to* offer my suggestions,—but to that nume-

rous and increasing class, occupying arable land not exceeding forty or fifty acres altogether, and who really require practical information, this little volume is offered. Each subject, as it will most probably occur to the reader himself, is arranged in its own order, and the whole circle of the year made to bring round its peculiar labours. The case of one wholly inexperienced has been assumed in the present instance, and the information necessary to enable him to meet the different emergencies of the farm carefully, yet succinctly, given in the following pages, so as to form what it is hoped will be found a useful manual of husbandry on a small scale.

MARTIN DOYLE.

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SMALL FARMS:

A Practical Treatise.

FARM OFFICES.

WHATEVER be the scale of farming, a stable, cow-house, calf-house, barn, cart-shed, implement and tool-house, pig-sties, poultry-house and yards, and a place in which food can be prepared for all sorts of live-stock by steam, will be indispensable.

The farm-yard should be so arranged that the fermenting litter from the stable and cow-house may be intermingled, and kept free from rain-water falling from the roofs of the buildings; this is easily accomplished by furnishing these with gutters under the eaves to catch rain and convey it into vertical tubes, from which it should be carried away from the yard. By having a dung-pit in the centre, covered by a light and inexpensive roof, and open on all sides, the manure can be kept dry from rains, and yet supplied with sufficient moisture from the liquids of the cattle-house and stable, conducted into it by channels of some sort to prevent it from drying up, and assist its fermentation and decomposition by their constant agency. Into this pit the used litter from the different animals should be daily collected and intermixed, so that the overheating tendency of the horse-litter may be checked by the cooler qualities of that obtained from the cow-house and pig-sty; and thus a mass of manure

will be blended together of excellent combinations. If the reservoir for the manure be covered, there should be a sufficiently wide margin around it to allow a labourer room for rolling the wheelbarrow to any side of it, and to afford a resting-place for the contents when forked out for filling into carts and removal to the land.

The quantity of putrescent manures lost by mere carelessness and stupidity, is of vast amount; whereas, if collected without loss of the ammoniacal liquids and salts, by tanks or cisterns,—such as are constructed even on the humblest scale of husbandry in Belgium, and combined with weeds and scourings of ditches, &c., these substances would fertilize a prodigious extent of land.

The depth of a stable should not be less than sixteen feet, and a breadth of six feet for each stall will be sufficient; but if there be only swinging-bails between the horses, five feet six inches will be room enough. The best description of bails is a bar, suspended in the usual way, to the underside of which a strong board of elm should be attached, the wider the better, hung with hooks and hinges, so as to give way when the horse rises up or lies down, and not less than a foot from the level of the stable-floor, lest the horse's legs should get under the hanging-board.

The Cow-house ought to be fourteen feet wide, and each cow should have four and a half feet width of space.

The Calf-house should have a boarded floor, inclining to some part, and beneath this a drain; a trough or box is the necessary furniture.

The Pig-sties.—These cannot be too large. The sleeping-sty for a breeding sow ought not to be *less* than seven feet by six feet, and the outlet ten by seven feet. A door in the back wall of the sleeping apartment, and another in the partition between it and the outlet or yard, will be found convenient, when it is necessary, for any purposes, to separate the sow from her litter. The dimensions for the accommodation of fattening, store, and weanling pigs, should be much larger, and in proportion *to the stock kept.* The aspect should always be south.

The Poultry-house should be so arranged as to have communication with a paddock, orchard, or some grass ground, to which the poultry can have frequent entrance, and also free access to the dunghill, where they will find grains of corn and offal suited to their appetites. The building itself should be fitted up with nests, on or very little above the ground, for laying; and an inner room will be necessary for nervous hens, which require especial quiet when brooding, or for the occasional separation of poultry for any purposes.*

A small tool-house with lock and key is very convenient, not only for keeping tools where they may be had at a moment's notice, but also for storing small seeds, sacks, &c.

IMPLEMENTS.

None of those ponderous, expensive, and complicated machines and implements used by the large farmer are adapted to the scale and the wants of the small cultivator. He is not to dream of a thrashing-mill, or large and powerful drill-machines, nor of huge ploughs for draining and subsoiling; nor is a waggon so well adapted to his purposes as the Scotch one-horse cart. It would be extravagant and absurd to expend capital on gigantic machinery for petty labours, which may be better performed by manual exertion or very simple mechanical contrivances.

The implements absolutely necessary on our supposed scale will be—

One or two Scotch carts.

A Scotch iron swing-plough for general work,—or such plough as local circumstances may render more appropriate.

A plough with a straight beam,—that is, with the beam forming the same angle with each of the stilts,—and with double mould-boards, that may be extended

* This subject has been so fully treated of in "The Poultry-Book," published by Messrs. Routledge, and edited by me, that I *shall not* here enlarge upon it.

or contracted at will, or removed, when hoes or scarifiers may be wanted to stir the earth between drills of turnips, potatoes, &c.

Light grubber.
Small drill-sowing machine.
Drill turnip harrow.
Pair of heavy harrows.
Pair of light harrows for seed covering.
Heavy cast-iron roller.
Light cast-iron roller.
Winnowing-machine.
Chaff-cutter.
Turnip-slicer.

A small steam apparatus for preparing food for live stock; spades, shovels, pick-axes, hand-hoes, digging-forks, potato-sprongs, stable-forks, hay-rakes, shears, scythes, sickles, riddles, sieves, seed-baskets, root-baskets, sacks, and set of imperial measures and weights.

Utensils for the Dairy.

Milk-pails, milk-pans, skimming-dish, strainers, American churn, common plunge churn, cloths, butter-prints.

On a small farm the Scotch cart is preferable to the English waggon, though on a large scale much may be said in favour of the latter. The ponderous waggon, drawn by two or three horses in line—a load in itself—has this decided disadvantage, that if the waggoner be careless, or drunk, the work will be unequally performed by the team, the leader perhaps straining himself to drag the horse, or horses, after him, and the others merely following, not pulling; or the contrary may be the case, the wheeler overworking itself and the leader not pulling at all. When each horse has its own cart each must work alike, and do its own duty. If one be yoked before the other in a Scotch cart, the load may press heavily on the back and loins of the shaft horse descending a hill, while the leader cannot assist in keeping back the load, and may, without the care of the carter, pull the poor brute, while vainly straining its muscles in opposition,

on its knees. Up and down hill the shaft horse must work, whereas the other ought entirely to relax draught on the descent, and never feel pressure on the back. If the line of traction, too, when the traces of both are strained, be not in an exactly straight line, there must be a loss of power, and this we observe to be a frequent case. The cart is more suited to expeditious movements, more readily loaded and unloaded,—and this, too, is a great consideration; but on rough and heavy roads I admit the superiority of the light waggon. The difficulties which a farmer may encounter in changing local practice in such cases are not trivial. Supposing any one to introduce a Scotch two-horse plough instead of one drawn by three or four horses, dispensing with a driver, and thus saving doubly, he may find himself in the predicament of an amateur farmer in Wales, who introduced a Scotch plough and insisted on its being used; whenever he went away, however, he found on his return that the new plough was thrown aside and an old one yoked in its stead. In a rage, he burnt the latter, and started the other afresh; on coming to the field one day he found the new plough in a ditch, and one of the old fashion, borrowed from a neighbour, at work. Finding it useless to struggle against obstinacy and prejudice, he gave up the contest.

Ploughs of one unvarying form, and with teams of four, or three, or two horses, are in many districts very injudiciously used in preference to the Scotch swing-plough, without due reference to the relative qualities or condition of the soil. The farmer finds his *local* ploughman dogged, and at the least throwing every obstacle in the way of any innovation; and then the farmers cry out, "Oh, Mr. So-and-so tried the Scotch plough with a pair of horses, but found it would not answer as well as our old-fashioned one." The plough (Scotch) which I am recommending to my present readers has not, with its undoubted merits, yet superseded the old Walloon plough with wheels, in many *parts of* England, where a great waste of animal labour *in ploughing* is constantly taking place. The Rotherham

plough, which probably suggested to Mr. Small his superior one, is the nearest approach to it which the prejudices of farmers, though intelligent in most instances, will permit, even in some English counties where agriculture is pre-eminently good. Small's plough (of wood) is drawn by two horses, and is capable of executing almost every kind of ploughing. Mr. Wilkie, who took hints from the former, has produced the very best modern iron plough. Some of these ploughs are light enough for one horse, in free soils and for drill culture.

A skeleton plough for cutting furrows deeply, an operation sometimes necessary, is one of the varieties of the implement which you may find useful; it is merely a plough without mould-plates, each of the handles forming the same angle with the beam, and the sock having a double edge. Morton's universal drill-plough is one of the best of this kind, when the mould-plates are removed; two circular coulters, or scufflers if required, are attached for paring the edges of the drills, and they are taken off when the mould-plates are to be put on.

Some of the most scientific mechanicians condemn wheels to ploughs altogether, as creating increased resistance to the progress of the implement, and quite needless to a *good* ploughman who understands the guidance of the Scotch swing-plough and the setting of its irons.

On the other hand, I think that the Scotch, and best Irish farmers, are wrong in not employing on stiff clay soils, and for deep ploughing, four horses instead of two, to the Scotch plough. Horses last so much longer from not being overstrained at their work, going on quietly and without too much effort; that, in the sort of work just stated, the employment of what under the opposite circumstances are supernumerary forces, will be found the cheapest and most effective in the long run.

If, however, the soil be so stiff as to require, at any time, a team of three or four horses, I must suppose, on the small scale of operations contemplated in this little manual, that you can employ hired labour for the occasion, or that you substitute *spade labour* instead,

which, where labourers are numerous and in want of employment, will be found, if not actually cheaper, the most effective in subduing the stubborn soil. One horse for drilling, rolling, and harrowing light soils will serve the purpose of the very small farmer, with spade labour; but we may expect soon to see a steam revolving machine constructed to turn over the soil in a manner that will completely pulverize it, and intermingle its constituent earths. Such a piece of mechanism is said to be near its completion, and it will be one of the greatest boons to agriculture. We shall then have occasion to substitute for "God speed the plough," some expression of gratitude in which the mighty engine of cultivation, which, it is to be hoped, will supersede that implement, shall have name and honour.

FENCES AND ENCLOSURES.

Whether the enclosures shall be few or numerous must depend on the size of the farm, the purpose for which it is cultivated, and the mode of husbandry pursued upon it; also on the necessity or needlessness of special shelter, and upon *taste*, and whether you will gratify this at the expense of strict economy.

An extensive tract unenclosed by perfume-breathing fences, abounding in

"Hedge-row elms on hillocks green,"

is an unpicturesque object in summer, and cheerless in winter, yet in economical calculation, the clearance of fences not absolutely necessary, is important.

When land is in perpetual tillage under a regular rotation, and every portion of it required for the plough or spade, no subdividing hedge fences are wanted. Besides the loss of land by hedge-row occupancy, the interruption of sun and air by foliage is at some seasons very *prejudicial*. But, if a farm be partly pasture, or *exposed to* harsh winds, hedge-rows, with timber for

shelter, are indispensable; the extent of them must then depend on local and other circumstances.

On lands exclusively for the pasturing of live stock, the condition of the animals cannot be advanced without separate fields, for the purpose of changing them from one to another. That this subdivision is useful will appear from the fact, that forty acres divided into four fields will maintain at least as much stock as one field of forty-five acres would support, because, while the stock are trampling and eating down the grass in one division, the herbage in another, being untrodden and uncropped, is growing freely. To prescribe any fixed rules on the subject of enclosures would be impossible, as their size and number must be determined by what has been stated. For an arable farm of about forty acres, such as I have assumed in the preface to be our model of illustration, four or six subdivisions (according to the rotations to be followed) are the extreme number that can be allowed; and in neither case should hedge-row timber be encouraged excepting on the marginal boundary of the entire farm. On very small farms not exposed to strong winds, there should not be, if avoidable, any of the regularly cultivated land occupied by fences. I make an exception in bleak situations, because in this case, notwithstanding the loss of the space occupied by the fences, the produce is earlier and greater than if chilling winds were unchecked in their course. In such positions full plantations of timbered hedge-rows may be economically afforded to a farm, giving it, with its pleasing aspect of embellishment, the reality of usefulness and comfort.

If there must be enclosed fields, those of a square form are the most desirable. It has been calculated that a square of thirteen acres is especially convenient for ploughing, as horses can at one breathing pull the plough two hundred and fifty yards, which is the exact length of any side of the square. But if squares cannot be conveniently formed, any parallelogram of the length *just stated* will be the most economical in form, as *respects the labour* of the horses; and as the direction of

the ridges should be from north to south, the longer sides of the parallelogram should be from east to west. The corners should be right angles, else great irregularities will arise; besides, a plough can turn over more of the soil in four square corners than in two obtuse and two acute-angled corners.*

A live fence in ill-drained clay, or peat soils, will require to have a ditch in front of the quicks, at least four feet wide at top, and the earth thrown out of this trench will form a protecting bank, at the rear of the young quicks, from wind prevailing on that side. It is not undesirable that privet should be intermingled with thorns, but not in a large proportion. The green hue in winter is pleasing, and the foliage of the privet affords some shelter to the sheep, when all else around is leafless. The breadth of ground intended for a young hedge should be well dug, perfectly cleared from weeds, and manured with muck. When the quicks (four years old) are planted, the usual practice has been to head them down immediately, but in more recent management this is postponed until the ensuing year. By putting up a single or double row of ash or larch rails, which will last until the plants have escaped all danger from cattle, and the fence has become established, the desired object is attained. Suitable hedge-row timber, whether oak, elm, alder, or sallow, will, however, not only afford the shelter that may be required, but serve ultimately for fuel, and many farm purposes.

In marshy places, where water rests in the ditches, the black willow serves to make a capital and ornamental fence, and the poplar tribe, interspersed with alders, which are now very profitable for the turner's purposes, are almost sure to thrive.

* Quarterly Journal of Agriculture.

DRAINING.

This is the very first important operation to be executed if it be necessary. I shall notice the ordinary circumstances under which a farm will require it.

A clay soil especially demands it. The closeness of its texture prevents the percolation of rain, which in free soils has a fertilising effect as it passes through them; but the surface becomes clogged in winter, because whatever rain-water does not escape by the furrows rests on the surface, until evaporated by the agency of the sun or of the wind, which chills the soil by the operation that dries it. The stagnant water rises in vapour, and deprives the surface of whatever latent heat may be present; and therefore, as the source of these chilling evaporations, it should be extracted by such drainage, which will render the soil permeable to water at all times, and afford it the power of discharging what it imbibes. The art of draining clay land uniformly affected by rain, is very simple; and though somewhat expensive, it ought to be among the first farm labours. It is wasteful to apply manure on land diseased by excessive moisture; until its condition be altered no satisfactory return of crops can be expected. Undrained clay demands more culture, more manure, and more seed than drained land of the same quality. In short, draining on any farm requiring it, is the best step towards its improvement. The late Mr. Smith, of Deanston, in Roxburghshire, if he did not originate the system of *thorough drainage* now so completely established, gave it the powerful impulse which has led to its general adoption, through the subsequent experiments of Mr. Parkes, and other gentlemen of intelligence and skill.

Mr. Smith was undoubtedly one of the first who showed how under-draining could, on clayey land, beneficially *supersede the previously* habitual and often laborious *practice of forming very* high ridges, with deep open fur-

rows, and permit the levelling of the surface and the consequent evenness of growth and ripening of the crops, with increased facilities also, for harvesting them, and working the land during all their rotations.

Mr. Smith having executed one hundred miles in length of drains on his own farm, published a pamphlet, in which he proved in a satisfactory way, that instead of the previous mode of forming the drains at right angles to the inclination of the land, or obliquely (as is still a favourite method with old-fashioned and prejudiced operators), the drains should run according to the hints afforded by nature, in the direction of the declivity. From frequent observation of the relative effects produced by longitudinal and oblique draining on a close subsoil, I am convinced that while there is a quick and unobstructed discharge of water under the former process, it frequently sinks, from the comparative sluggishness of its course, into the earth beneath the drains, and oozes out to the surface at some lower part of the field, yet above the next transverse parallel drain.

The practical details of *thorough draining*, as performed by Mr. Smith and his innumerable followers, are these:—having marked out the parallel drains directly up and down the inclination of the field, with intersecting ones in any intermediate hollows which might occur in an uneven surface, one of the labourers dug off a spading about fourteen inches wide, and cast it to one side; another followed in the trench thus commenced, with a spade of narrower dimensions towards the bottom, and cast the yellow clay to the opposite side from that where the surface soil was laid; a third workman followed with the pickaxe, if necessary; and a fourth, with a very narrow scoop shovel to clear out the bottom earth, leaving the drain thus formed, and in depth from twenty-four to thirty inches, as narrow as possible below. The cut being thus completed, and with a gradual fall from end to end, tested by the regular flow of water after the last spading, and without any respect to irregularities of the surface, stones broken to the size of a pigeon's

egg, or screened gravel, were cast into the bottom, to the depth of nine inches, covered with a tough sod inverted; about two inches of clay being trampled over it, a sufficiency of the excavated earth was then shovelled in, the small remainder being scattered over the field. It was found, contrary to preconceived theory and practice, that the most cohesive subsoil clay might be laid over the stones, to form a permanent incrustation, so that the moisture should only enter the drain below, by lateral pressure. In preceding practice, the unnecessary trouble of carting away the yellow subsoil had been incurred, it being supposed that if laid over the stones it would have obstructed the passage of the surface water to them.

Draining tiles, with or without soles, according to the quality of the bottom, became general in clay soils—where stones are not found; and these have been in their turn superseded by pipes, which being cheaply manufactured, are perfectly effective, and leave without excuse the owner or occupier of wet land who does not drain it.

In stony land affected by springs, it is both economical and convenient to use the stones as the material of drainage; and these are the least likely to prove *defective* from any causes, through the lapse of time: but under the ordinary circumstances of the cost of labour, in breaking the stones, filling them in, &c., pipes are the cheapest, and in clay districts the only durable conduits to be recommended.

Mr. Parkes is an advocate for deeper draining; and as a general rule, four feet drains are the best. Shallow ones, in discharging water after heavy rains, carry away some of the fine particles of mould and manure; and though it may appear at first view improbable, deep drains carry off water falling upon the surface sooner than shallow ones, and also discharge water stagnant beneath the upper clay stratum, where shallow drains would fail in doing so. One or two of Mr. Parkes's experiments on this point are interesting, for they prove that by deep *cuttings, a pan of clay*, retentive of moisture, may be relieved by the spade giving vent to the pent-up fluid,

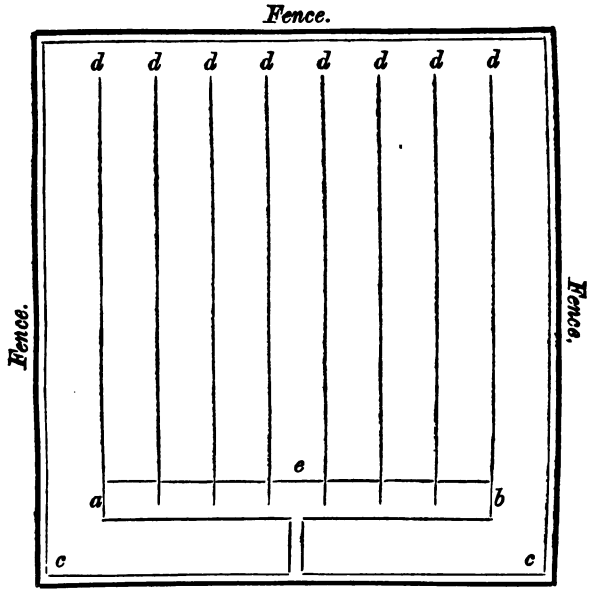
which is let off through a porous stratum intersecting. He was called upon to examine a field in which drains three and a half feet deep had been sunk without effect on the water below, and it was therefore supposed that drains, two feet deep, to carry off the surface moisture, would equally answer the purpose. To ascertain if there was a porous stratum below the deeper drain, he made a hole in the putty-like clay, between four and five feet deep, and it soon filled with water. He had therefore found the level of a porous vein; he then cut a drain fully five feet deep, laid pipes below, and puddled clay over them to within thirty inches of the surface, and on this level and over this puddled water-tight clay he laid a second course of pipes, so that he had two drains at different levels in the same trench, of which the lower was so protected by the close clay over head, that none of the top water could intermingle with that at the bottom. At *first* the rain-water passed away through the upper line of pipes; but, shortly afterwards, all the water passed through the lower drain, which discharged a gallon of water every minute during seventy-six days, and then the run came to a mere dribble. One of the most convincing proofs that deep drains do their work most effectually in removing surface water is, that shallow drains between deep ones have been found quite dry when the others were discharging water, perfectly clear too (and therefore not running off with any of the soil), soon after rain. The relative distances between the parallel drains being increased (but with due reference to the texture of the subsoil and its degrees of porosity) by deep draining, the saving in the number of pipes used for any given area under deep draining, and also in the number of holes to be cut, will counterbalance the increased cost of cutting the deeper drains. I have, however, seen drains in a clay of exceeding closeness and homogeneous texture, without pebble, or any symptom whatever of fissure, or opening of any sort, and without any ascertained stagnant moisture or springs beneath; in this case very skilful farmers *asserted,* and perhaps with perfect correctness, that it

was useless to make drains deeper there, than thirty inches. Though favouring the deep-drain system in opinion, I cannot dogmatically lay down a rule of depth in all cases, as the most practical men differ in opinion on the subject. I would rather urge the adoption of Mr. Selby's suggestion: "Make three short drains early in the autumn, one of two and a half, one of three, and one of four feet deep. The drain that first discharges the water after rain will be at the proper depth for that soil."*

The theory of deep draining is to this effect: though at first, surface-water finds its way but slowly to the pipes, each succeeding fall of rain will descend with less difficulty through the fissures which the preceding current had forced open. These fissures in the mass of soil and under-soil will become more numerous and ramified, not only for the admission of water, but for the circulation of air, which will enter through their interstices into the pipes, especially when containing little or no water. The oxygen of the air, by its chemical agency, dissolves mineral substances in the under-soil, and renders them beneficial to the roots of plants. The sun's heat, also, draws up moisture from below, and by the ascending force of this, the porosity of the soil is promoted. Thus does deep draining act with mechanical and chemical benefit to clay soils.

In thorough draining, without extremely considering exceptive cases, four feet drains may be considered the rule, and the distances from twenty-five to thirty feet. That is a false economy which would extend the distances: and even closer and deeper drains will in some instances be found expedient. As the outlets of all the drains should be kept clear, it is better to have as few of them as circumstances will conveniently permit, and therefore, instead of cutting all the parallel drains through the lower headland into the external ditch of any field into which their contents might be directly discharged, to let them meet a main (covered) drain (marked *a b* in the diagram),

* Agricultural Gazette.



parallel to the ditch, and discharging into it at one or more points, according to the extent of the field, and the locality of lowest declination. The diameter of the pipes in the main drain in this case should be three inches, and that of the parallel drains two inches.

The drainage of lands affected by springs or under-water is conducted on different principles. The cause of the distempered condition of land so affected is the obstruction of under-water in its course, by stiff clay, rock, or other impenetrable substance. Being stopped by such obstacles, it is at length forced to the surface, where it breaks forth, by the pressure of water from a higher source, and trickling with its *chilling* influences near the surface, it only encourages

the growth of rushes and other worthless aquatic plants, while it impedes the progress of beneficial vegetation.

The immediate source of the wetness must be ascertained, and removed by drains, deep or shallow, according to the depth of the springs, and local circumstances, and by the shortest line to the main drain. Sometimes, one deep drain meeting several springs dries the ground. The growth of rushes will to an experienced eye indicate the direction of the spring, which requires tapping or excision. Sometimes several springs issuing from porous strata may be carried into one drain. Where water lodges in a hollow, as in a bowl-dish, and without the possibility of cutting a drain at a lower level, and carrying away the water, the only remedy that I can suggest is to sink a pit until a porous stratum is reached, and then to form drains if necessary, radiating to this as a centre, into which they may convey the stagnant water. The moisture is of course retained in such hollow by the impermeability of a clay subsoil, which must be cut through, if by the application of an auger it be not found of excessive depth—a very unlikely matter.

SUBSOILING.

The thorough drainage of clay land that is to be tilled, is incomplete unless followed by subsoiling, so that it shall afford a free passage downwards to the farther percolation of rain-water, and allow the fibres of the roots of cultivated plants to penetrate through it in search of food. This loosening of the under-soil about a year after the thorough draining, was urged as a very essential matter by Mr. Smith, who constructed a powerful plough for the purpose (requiring a team of six horses in a strong till), *following the ordinary fallow plough, used for turning the surface furrow.* Such an operation as this is out of

the question with those whom I am addressiug (unless they can hire a team and plough for the purpose), but they may easily provide a second plough, following the first, to loosen as much of the subsoil as practicable; and this can be done by employing a common plough without a mould-board, as the under surface is not to be brought upwards, but merely loosened where it is.

A great deal of subsoiling might be effected by strong digging-forks, employed in the intervals between the highly-raised ridgelets of green crops, the surface mould having been hoed off to the right and left.

On clay land with retentive subsoil this work of subsoiling is principally necessary; but experience has shown that even the productiveness of gravel is increased considerably by subsoiling.*

* The Right Hon. Charles Shaw Lefevre, Speaker of the House of Commons, made an interesting communication to the Royal Agricultural Society, from which it appears that in consequence of hearing "the interesting evidence of Mr. Smith, of Deanston, before the Agricultural Committee in the House of Commons, it occurred to him to apply the subsoil plough, which had worked such wonders in a clay soil, to a dry burning gravel."

The effect of the experiment is shown by a statement of the produce of a field of six acres during a series of seven years.

Year.	*Crop.*	*Produce per acre.*
In 1832.....	Oats.....	Four sacks.
1833.....	Turnips	Not quite two tons.
1834.....	Barley.....	Not quite four sacks.
1835.....	Clover.....	Two tons on the whole field.
1836.....	Wheat	Three sacks.

In the autumn of 1836 it was ploughed with the subsoil plough, at the cost of 3s. per acre.

1837.....	Turnips	Eight tons per acre.
1838.....	Barley.....	Ten sacks per acre.

In other respects the land received the same treatment during the whole of the time.

ROTATIONS OF CROPS.

The order in which crops ought to succeed each other is not a matter of uncertainty or caprice. Allowing for variations which local circumstances and the peculiarities of the soil may render expedient, the following rotations have been established by the best farmers in Great Britain.

On light and all loamy soils, the four-course rotation, termed the Norfolk system, is the most approved, viz.:—

1. Turnips.
2. Barley, with Clover Seeds.
3. Clover.
4. Wheat.

On clay soils a six-shift rotation is better, viz.:—

1. Beans.
2. Wheat.
3. Swedish Turnips.
4. Oats.
5. Clover.
6. Wheat.

But variations are not only admissible, but expedient, to obviate the too frequent recurrence of clover and turnips in the former course, and to admit in the latter of such substitutes and intercalary crops as will tend to improve the soil, and at the same time extract from it the utmost amount of produce consistent with good farming; for instance, in the four-course rotation, pease and potatoes (sown in January or February) may be in *part* substituted for turnips after wheat; and the Prussian blue, or six-week turnip, may succeed the pease, and thus an intercalary crop is gained.

Another Norfolk rotation is, wheat, turnips, barley, clover or seeds, oats, potatoes; and on land too stiff and wet for turnips,—

One-fourth wheat,

One-fourth oats,
One-eighth beans,
One-eighth vetches,
One-eighth clover or grasses,
One-eighth fallow.

Besides the qualities of soil, the means of manuring it, and the relative market value of crops or of profits in any particular branch of rural economy, must have much influence in determining the rotations to be followed. Very light soils, though easily cultivated, are often improved by long intervals of rest, and pasturing by sheep; yet even on these, great facilities of manuring may turn the scale of profit in favour of constant cultivation. Clay soils are improved by frequent ploughings and harrowings, whereas those of the extremely opposite quality would be injured by much working. Again, some soils, if allowed to rest, have a tendency to produce excellent herbage; others, not kept in regular tillage, are comparatively worthless for grass, and the longer they rest the worse they become. But, generally, all soils of intermediate qualities, between the lightest and heaviest, are suited to the Norfolk rotation, which supplies a complete manuring twice in every four years, prohibits the production of two consecutive corn crops, and also insures the regular and constant cleanliness of the land. And though the soil may naturally be so loose and light as to be unfit for wheat under ordinary culture, the roots of clover have the mechanical effect of binding it sufficiently to afford to the succeeding wheat plants that secure hold in the ground, without which they would fail. The fallowing process in the preparation of the land for turnips clears it from couch and other weeds generated during the previous months: but experience has shown that, after long continuance of the Norfolk system on any farm, both turnips and clover will occasionally fail. The best German and Belgian farmers have long since discovered the bad results of introducing turnips and clover too often in the rotations, and they contrive variations by which these crops are brought in but once in eight or even twelve years.

Before it had been so well ascertained that neither of these crops will bear too frequent repetition without exhibiting evidence of failure, Mr. Pusey, late M.P. for Berkshire, a most distinguished friend and patron of British agriculture, remarked in one of his valuable publications, that "though the Norfolk or alternate four-course system of husbandry has conferred such great though silent benefits on the country, it may be doubted whether the system have not accomplished all that it is capable of, and must not pass into another; already it has begun to fail in one of its green crops, probably in the other." But admitting that the degeneracy of those two crops on land where they had been cultivated during a lengthened period, be attributable to their too frequent recurrence, and not to other causes, there need not be apprehension of this, on any farm newly brought under the rotation in question. It will be time enough to make some changes when the symptoms of the decay of these crops shall appear. The substitution of rye-grass, trefoil, Dutch clover, and Italian rye-grass and vetches—in part, for the ordinary red clover, relieves to a sufficient extent; and having one-half the turnip crop of the Swedish sort, —the other half being green, round, or any other good variety, meets the objection in some measure (as regards the occupation of one-fourth of the land by turnips), because the tap-rooted Swede and the fibrous globe do not feed upon the soil in the very same way. A portion of the turnip division may also be devoted to carrots; and this is an admirable crop for culture on appropriate soils, properly treated. The objection to any crops, which are not to be fed by sheep on the ground, is, that there is a loss of manure so far, and a corresponding derangement of that which constitutes an excellence of the Norfolk system, viz., the consumption of the root crop by sheep, upon the ground, both to manure and consolidate it. The latter advantage, however, is chiefly important upon sandy soils, such as Norfolk in some parts consists of. But the pre-eminent advantage of the course is, that by the alternation of white and green crops the land is kept continually

clean, and manured without aid from adventitious fertilizers.

In the second rotation above-mentioned, the sorts of turnips may be varied, the preference, however, being given to Swedes; and drum-head cabbages and Jersey parsnips to some extent are valuable substitutes. Vetches may precede turnips in the same year. Rape, fed off by sheep, is a good substitute for clover, and a good preparation for wheat; and the land under this latter crop, instead of being winter-fallowed immediately after the harvesting of the grain, may to some extent be sown with "six-week" (a stubble) turnip, to be fed by sheep; and thus the land will gain an additional manuring in compensation for what it may lose by not receiving an early and deep winter ploughing.

A farmer suggests, for clays of the lighter quality, these two rotations:—

1.—First year, manured fallow; second year, wheat; third year, beans; fourth year, wheat; fifth year, seeds.

2.—First year, oats; second year, beans or tares, to be ploughed in green and limed; third year, wheat; fourth year, clover; fifth year, oats.

Admitting that the reputed degeneracy of turnips and clover on farms where they had been cultivated during a long course of cropping, is attributable to their too frequent recurrence, and not to other though unascertained causes, there will be no ground for apprehension of such degeneracy on any farm newly subjected to the rotation under our notice. It will be time enough to make some changes when the evidences of their decline shall appear. The substitution of carrots, parsnips, cattle beet, and potatoes, for turnips, on a part of the division systematically devoted to them, affords an obvious remedy in the case of the turnip. And may it not be, after all, that malformation and disorders such as "fingers and toes" in the turnip, like deformities in the animal frame, may proceed from non-infusion of fresh seed, deficiency or unsuitableness of manure, shallow *ploughing*, or want of drainage, rather than from the

recurrence of the turnip on the same land every fourth year? Similar reasoning would of course apply to the case of clover.

If there be truth in the theory suggested, that plants which can only be raised directly from the seed, do not degenerate, the turnip ought not to fail. The varieties in the vegetable world, obtained by grafting, budding, cuttings and tubers, &c., do exhibit signs of degeneracy in the progress of years. The varieties of the cereal crops are as healthy as when originally obtained, and furnish a strong evidence in favour of the foregoing conjecture.

The perfection of the turnip crop in due rotation and full proportion, is most important, because, however the substitution of other green crops may provide a sufficiency of roots, &c., for cattle and sheep in close confinement, it deranges the system which experience has proved to be the best, and which rests its superiority, as previously explained, on the application of the green crop in question, to sheep, on the ground which produced it. On light land, requiring the consolidation which sheep effect upon it, anything which interferes to render unavailing the economical mode of manuring the land by means of these agents, is a positive loss. Indeed, it may be hoped that the change from one sort of turnips to another, as from Swedes to globes, or *vice versâ*, may prove to be a preventive of failure.

The great principle to be maintained is, that cereal and green crops should alternate to preserve the land in a clean and fertile state, without the aid of extraneous manure. The profit also at present derived from feeding sheep renders it the farmer's interest to cultivate those crops which can best maintain them, while they in return yield to the land elements of nutrition for such portions and kinds of corn crops as it may be beneficial to cultivate.

Yet the very small farmer ought not to keep a stock of breeding sheep, which would be very troublesome; but let him buy a hundred lambs in the autumn, to eat *off his (supposed)* ten acres of turnips, and sell them fat *in the next spring*, after shearing. Shifting the hurdles,

and some protection to the lambs after they have been clipped, will be almost the only trouble they will occasion. The ten acres will be well manured by these lambs, which will realize a profit of from 10s. to 15s. each, at the present rates.

One of the great advantages resulting from the copious supplies of artificial manures is, that any prescribed rotation can be commenced and established without difficulty or delay; whereas formerly, unless straw was produced in large quantities, it was almost impracticable, under prevailing notions and practice, to raise enough of green crops. Now, for a trifling sum, various fertilizers can be purchased by which any green crops may be abundantly raised. If these be consumed by sheep on land, however previously out of condition, it will be so renovated that any rotation may be set going and kept in regular revolutions, each subsequent crop preparing almost with mechanical precision for that which is to follow.

A table* of rotations for a farm of a hundred acres was arranged some years ago by Mr. Blaikie for the French government. With ample means of manuring, it is unobjectionable; but that must be an excellent soil indeed which can produce good crops of wheat four times in seven years.

The following observations of Professor Anderson† are strictly appropriate to the matter under immediate consideration:—"The necessity for a rotation has been usually attributed to different crops removing different inorganic constituents from the soil. Thus, certain plants require for their luxuriant growth a large quantity of potash: and they must be followed in the rotation by some other plant which does not extract that element from the soil, or at least only in a comparatively small quantity, and each individual crop can only be successfully repeated when, by the lapse of time, a sufficient quantity of its characteristic constituents has been liberated from some inert form of combination, in which it exists in the soil."

* See next page.

† *Transactions of the Highland Agricultural Society.*

First Year.	Second Year.	Third Year.	Fourth Year.	Fifth Year.	Sixth Year.	Seventh Year.
Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
15 Wheat ..	2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots	5 Oats .... 2½ Barley ..	7½ Clover	7½ Wheat....	5 Potatoes 1½ Vetches 1 Beans ..	15 Wheat.
	5 Potatoes 1½ Vetches 1 Beans ..	7½ Wheat....	2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots	5 Oats .... 2½ Barley ..	7½ Clover ..	
7½ Clover....	7½ Wheat....	5 Potatoes 1½ Vetches 1 Beans ..	15 Wheat....	2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots..	5 Oats .... 2½ Barley ..	7½ Clover.
2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots	5 Oats .... 2½ Barley ..	7½ Clover ..		5 Potatoes 1½ Vetches 1 Beans ..	7½ Wheat....	2½ Turnips. 2½ Cabbages. 1½ Field Beet. 1¼ Carrots.
5 Oats.... 2½ Barley ..	7½ Clover....	7½ Wheat....	5 Potatoes 1½ Vetches 1 Beans ..	7½ Wheat....	2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots..	5 Oats. 2½ Barley.
5 Potatoes 1½ Vetches 1 Beans ..	7½ Wheat....	2½ Turnips 2½ Cabbages 1½ FieldBeet 1¼ Carrots	5 Oats .... 2½ Barley ..	7½ Clover....	7½ Wheat....	5 Potatoes. 1½ Vetches. 1 Beans.

On examining the above rotations, it will be seen that those ameliorating crops to which a fertile loam is suitable are introduced freely, and in varied intervals, so as to render succeeding crops remedial of any bad effects that might have ensued from the preceding ones; and this should be a paramount consideration in all rotations. The table is obviously capable of adaptation to a much smaller extent of farm, and especially suitable to the class of cultivators to whom it is here presented.

I shall now suppose that you have decided on pursuing the Norfolk course of cropping, on forty acres of sound loamy soil, and that you desire as quickly as possible to have ten acres under turnips, ten under barley, ten under clover, and ten under wheat. The spring season we shall suppose to be commencing, and in bringing about the four-course rotations, the annual routine work of them will elsewhere be duly noticed.

The Preparation of the Land for Barley.—A sandy soil will require little ploughing. A clay soil, especially if the previous crop of turnips has been fed off in wet weather, will require two, if not three good spring ploughings and harrowings; and the success of the crop will greatly depend on the perfect pulverization of the heavy soil. When this is reduced to a friable state, and the weather is favourable, and showers probable, procure seed of the Chevalier sort, at the rate of two bushels and a half to the acre; a little more will be necessary if the land be not in good tilth and of good quality. Sow the seed with a drill-machine, in rows six inches apart. If you have not a machine or the power of borrowing one, broadcast sowing will answer almost as well. The advantage of drilling, causes a saving of seed, and greater facility of growth to the clover-seed, which should be sown with the last turn of the harrow, and rolled immediately afterwards. The proportion of clover-seed is fourteen pounds to the acre. But instead of having the entire of the ten acres sown with common red clover, a portion of cow clover, *Trifolium pratense perenne*, not being hollow in the stem, but able to stand dry weather, and blossoming later

than the other sort, and therefore succeeding it, should be substituted on a part of this division.

Italian rye-grass may be sown on a small portion immediately after the barley has sprung up, at the rate of two bushels and a half to the acre. It is especially good for milch cows and horses in the spring, when, on warm soils and in shelter, it affords a very early cutting. Before the first of May, in a forward season, it may be mown; and the advantage of having succulent food, that is not rank in flavour, for cows at that time, will be appreciated by those who, from want of such food, are obliged to feed new milch cows on dry hay and turnips, which will occasionally impart an unpleasant taste to cream and butter, even with the precaution of putting nitre into the milk-pail, or using any of the other preventives that may be adverted to in the course of my observations.

Preparation for Turnips.—Cross plough deeply: to whatever depth the land may have been winter fallowed, it will now require to be stirred to the utmost deepness that the plough, drawn by a pair of stout well-fed horses, will reach without distressing them. Then, harrow thoroughly, roll and clean the land, and when the time for sowing arrives, plough again in the same direction; and repeat the ploughing and harrowing if necessary. Cart out short well decomposed manure, laying down the loads in rows of about twenty-one feet apart. Form drills (if for Swedes) twenty-seven inches apart, with the plough, which should go up and down each furrow, throwing the earth to each side at the same angle, and leaving the drill-furrow wide and deep enough to hold the due allowance of dung or compost. The manure is then to be covered by the plough working so as to back the furrow slices in its boutings, raising ridgelets where the hollows had been. These should then be rolled lengthways, so that the surface shall be nearly level, the ribbed parts being almost flattened after the rolling, and the dung being completely covered. The seed is then to be sown from a drill-barrow, having a tiny roller attached to it, which covers the seed effectually. Besides other reasons, which will more pro-

perly come under the head of manures, the application of two cwts. of *pure* guano to the acre, drilled with the seed, is most beneficial, and a sure preventive of the fly that so often destroys the turnip crop. The pungent ammonia prevents the fly from taking up its quarters among the young leaves, and depositing there the eggs, from which myriads of *larvæ* would issue. Of course, some corresponding reduction in the quantity of farm-yard dung may be made if the guano be given. It cannot be denied that the broadcast method of sowing, by which the manure is evenly distributed over the surface and blended with it, has theoretically much in its favour; but, on the other side, the advantage of having the turnip seed in uniform and close vicinity to the manure is important, to stimulate and nourish the growing plant. The ventilation conveyed through the intervals, and the more easy after culture, of thinning, hoeing, weeding, and water-furrowing if necessary, afforded by the drill system, turns the advantage in its favour.

The reasons for preferring the Swedish turnip (*ruta baga*) to any other sort are chiefly these: it is more solid (though it does not generally attain more weight than the oval or the globe sorts, whether green, white, or purple-topped, which become stringy and innutritious soon after Christmas); and it is the best keeping turnip, remaining sound even to the end of May. The yellow Aberdeen, and Dale's hybrid, emulate it in these properties, but are not so nutritive. Therefore, as I assume that you can supply the greater quantity of manure which the tap-rooted swede requires, and that your land is in good condition, I give it the preference for the main crop.

For the early feeding of sheep, Skilling's Liverpool turnip is one of the varieties most approved by the best farmers in Berkshire, where great diversities of soil exist. Some globes from the commencement of the winter season, and before the severity of frost, are requisite. These I would also sow in drills. On very light sandy and inferior soils, generally, the Norfolk may be one of the most suitable; deriving much of its nutriment from

the atmosphere, it can thrive with a moderate share of manure, which circumstances may render a matter of some consideration.

In cases that require a late sowing, as on half fallows, which may be occasionally desirable, the Swedish turnip would not be suitable, as it ought to be the first sown.

Land that is sufficiently loamy for the Norfolk system of culture will admit of the substitution of carrots, to some extent, as the root crop. These are excellent for horses, pigs, and poultry. The culture is as follows:—the preceding autumnal ploughing should be as deep as possible, and the best mode of giving a very deep ploughing is to set a second plough after the first, to trench the ground in some degree; for on the deep and thorough pulverization of the land the success of the crop will chiefly depend. The ground should receive a cross ploughing early in March, when the manure should be turned into the soil, so as to be incorporated with it before sowing the seed in April, else some plants might fork, from coming into contact with fermenting manure. On account of separating the seeds sufficiently for drilling, it is usual to sow them broadcast, and afterwards hoe out the supernumerary weeds.

Mr. Burrowes, a very distinguished Norfolk farmer, who used to cultivate carrots to a great extent, hoed the crop in about five weeks from the time of sowing. The Altringham is one of the best sorts.

*Mangold Würtzel.**—Let us exchange this tremendous mouthful of words for cattle-beet. On prime land, this should be—but in a small proportion—a substitute for the Swedish turnip, as it is admirable food for milch cows, pigs, and poultry. There are two sorts, the red and that which is yellow internally; the former is best known and most approved, although the latter contains more saccharine matter. At the end of March, or the beginning of April, the land is prepared as for drilled Swedes. When the ridgelets have been rolled, the seed is either dibbled in,

* Familiarly and vulgarly called *Mangles*, a mutilation not to be tolerated.

or dropped in a little furrow drawn with the point of a stick, at distances of eight or ten inches, or closer, if there is apprehension of the failure of any of the seeds. This is a better mode than dibbling, because, in doing this, the workpeople sometimes omit to put seeds into a hole, or else sow too many; and if the earth be cohesive, it is apt to harden about the hole; and in thinning out the supernumerary plants with the finger and thumb, the fibres of those left standing are frequently injured by the act of disengaging the others from them. Two pounds of seed, if fresh and sound, are enough for an acre.

After the plants are well up and strong, about the size of early garden carrots when first brought to table, they may be thinned out permanently to the distance of sixteen or eighteen inches, if there be reason to expect a luxuriant growth.

Cattle-beet does not affect the taste of cream and butter in any unpleasant degree; but comparing it with Swedes for profit, as to fattening properties, there are contradictory opinions. The late Lord Althorp tried experiments accurately, and the results with his lordship were in favour of the cattle-beet. It should not be given in large quantities at first to cows, as it is relaxing to the bowels. Salt should be occasionally sprinkled over the well cleaned and sliced parts. Four stone a day is a good allowance for a milch cow, and double this proportion for an ox or large cow when fattening. Pigs eat it greedily, raw or cooked, but it is seldom given to horses, though I should suppose it to be good for them in small quantities, if steamed or boiled. From the middle of September to the first of November, the leaves are useful for milch cows and store pigs; when the leaves begin to droop they cease to perform their functions for the plant, and are therefore no longer of any use to it; but those which are in their full vigour should, if removed at all before the crop is about to be carried, be sparingly stripped off. The manner of protecting this valuable root in winter is precisely the same as that observed with regard

to Swedish turnips and potatoes when pitted in the field.

Clover and Haymaking.—If you have a due proportion of clover from the sowing of the preceding year, you will have to convert the principal part of it into hay about the middle of June. I shall suppose that some of it has been previously mown for soiling: mow the main crop before the blossoms are ripe, particularly if any rye grass is mixed with it, else the stems of this will be hard and wiry, and deprived of their nutritious qualities. If you can seize upon a favourable time, with the wind N. or N.E., the probability is that you will cut and carry the crop without its receiving a drop of rain. Never wait beyond a week of propitious weather, even if the clover be a little under-ripe, on the chance of the continuance of such season. By cutting early, too, the second growth will be accelerated and more abundant, and the land less exhausted than if the flowers had been allowed to ripen. Instead of saving seed from the second, and therefore twice-mown, crop—a frequent practice—feed off a portion of the first until the end of May, and reserve the second growth of that part for your seed. By letting the first crop mature their blossoms, the second crop may be too late for ripening favourably; besides, the plants will be more vigorous from not having suffered the exhaustion of a second maturity.

Clover will not bear tedding like common grasses; the leaves crumble, or become discoloured, if exposed to too much weather. The best mode of saving it is to turn it over with a hay-fork, until, by the evaporation of superfluous succulence, it has shrunk at least two inches in thickness.

From the small cocks in which it should be saved, it may be ricked on the fourth* day in real summer weather, but in our uncertain climate, rain will often interrupt the process; nothing then can be done; wait with due patience

* Irrigated meadows, and all heavy crops on low lands, may *require a great* deal more time.

for a dry day. The self-fermentation of the clover, by which it retains its nutritious juices, and only loses its watery particles, is the true principle by which the process of converting clover into hay should be conducted. The Rev. Mr. Klapmeyer, of Courland, has made both his theory and practice known in England through Mr. Taylor, who some years ago, in a very lucid manner, conveyed the communication to the editor of the "Irish Farmer's Journal." By his process the sap-vessels are expanded by the circulation of the juices through the agency of heat, and the excess of humidity is dissipated; on cooling, the sap-vessels contract, and thus future internal fermentation is prevented, and the nutritive elements are preserved. Mr. Klapmeyer allowed his clover to remain in the swathe* until four o'clock P.M. of the day following the morning of cutting; it was then raked into little cocks, and afterwards put together for fermentation into very large ones, trampled down by one or two men's feet to accelerate fermentation, which, if the night be warm, will commence in a few hours. After a sufficient fermentation arose,—proved by the usual appearances of smoke in opening out the clover, and some change of colour, it was spread out, and in the afternoon (of the third day) carried into the barn without danger of a second fermentation. This is an excellent mode of producing the fermentation by which the saccharine qualities are developed; "it resembles," observes Mr. Taylor, "in some degree, the process of making malt from barley, and requires similar attention."

Heavy rains fall in Belgium, as in England; therefore the intelligent gentleman who has made known the details of the process in favourable weather, gives ample directions for saving clover in unfavourable seasons, when partial fermentations will occur amidst delays and interruptions. His principle seems to be, that intestine fermentation should be induced, though it may be by slow degrees; he recommends, therefore, the separation of the

* "With tossing, and raking, and setting on cox,
Grasse, lately in *swathes*, is meat for an ox."—TUSSER.

unfermented portions from those which have heated, for the purpose of undergoing the process at some time of the course. The closing remark of minute and lengthened details is important:—"The fermented clover remains good, even if it continues some weeks exposed to the rain, provided it is at last suffered to dry before it is put into the barn, otherwise the wet from the rain will render it musty and bad. The clover which has been for so long a time exposed to the rain will not, however, be so nutritious as that which has been well fermented and sooner dried, but it will be superior to that which has been exposed to the rain and got up in the common method."

As you may have some part of your lawn, or a field not included in the regular farm department, under meadow, I shall briefly notice the ordinary haymaking process, though not a part of the Norfolk system, in order to dismiss the subject of which clover-haymaking is a branch. For your carriage-horses, hunters, and roadsters for fast work, if you have any of these, for which clover-hay would be too *foggy*, hay of a less succulent quality will be necessary.

In England, the art of haymaking is admirably understood, though from the rapidity with which it is sometimes ricked, to obtain early fermentation, much hay is often destroyed by spontaneous combustion, and never more frequently than in very bright weather, when the sun produces in it a deceptive appearance of its having sufficiently parted with its moisture; the consequence is that it heats excessively, emits smoke, takes fire, and is consumed, or, if saved from combustion, is so *fire-fanged* as to be deprived of all its alimentary properties.

Meadow grass is tedded out and separated as much as possible, a few hours after the mower has cut it down, and turned at intervals to expose it equally and thoroughly to the influences of the sun and air. If the weather be fine, that which was cut before breakfast hour may be gathered into windrows, and put into little cocks on the same day. On the ensuing day these cocks should be *opened* out when the dew has evaporated, and the already

half-made hay repeatedly turned during the day; in the evening the rows may be doubled, and made into much larger cocks than on the preceding day. On the fourth day, what was first mown may be carried for the rick; and by having a tarpaulin with a suitable framework and ropes, the succeeding quantities of hay according as they are saved, can be ricked; or, if rain falls, left out, for a favourable time, while the portion under the tarpaulin is safe.

When a few acres only are in question, these should be cut down, as in the preceding instance, as rapidly as possible, one good mower cutting an acre as his day's work; and the cost of a tarpaulin may be dispensed with, though it is very useful in any case, to protect the hay from dew or rain during the formation of the rick; and where one is available the field cocks can be brought to the rick as fast as they are saved. Unless for horses which may require to be limited in their allowance of water, it is desirable to sift salt very evenly through each course of hay, at the rate of fourteen pounds to the ton, and some people add coarse sugar to it, which gives it a flavour of which horses are very fond.

If there be any reason to apprehend danger from atmospheric moisture in hay, layers of straw may be introduced with good effect. A neat farmer will thatch his rick immediately after it is finished.

The last division of our four-shift course is appropriated to

Wheat Culture.—After the clover has been eaten down, put out the manure intended for the wheat, and plough it into the ground immediately after harvest, either in wide or narrow lands, according as the soil may be dry, or ill drained and requiring frequent furrows. The machine called a drill-presser, with one or two metal wheels moving in the seams *a*, *a*, *a*, between the furrow slices , which ought to be inclined as nearly as possible at an angle of 45°, is of great use for consolidating light soil. If the seed be accurately sown broadcast, it will fall into these troughs, the harrowing (lengthways) covers it, and it will come up in drills

of the breadth of a furrow. But farmers think it so difficult to find a sower who can distribute the seed evenly and not too heavily, that they prefer (at least in my present neighbourhood), after using the presser, if the soil requires such consolidation, to harrow the surface afterwards; the seed is drilled by a machine across the lands or stitches, and in rows of from seven to nine inches, between which a small hand-hoe can be introduced in the spring. The land is rolled after the harrowing, if necessary.

As to the sort of wheat, it will be prudent to attend to local experience. The Golden Drop and the Red Lammas are the most generally sown.

The white kinds are more prolific in a dry warm summer, and on good soil, and more prized by the miller, than the red varieties; but the uncertainty of a favourable season, and the greater difficulty of harvesting the more delicate white grain, gives, in the maritime and more exposed parts of the kingdom, a decided superiority to the red. This is preferred by many farmers, even in the midland counties of England, and such other districts as are not subject to the atmospheric humidity prevailing in the vicinity of the ocean, and in the northern counties. By an experiment made by Mr. Morton, published in the journal of the English Agricultural Society, it appeared, as far as a single experiment could test the matter, that out of sixteen varieties, the old red Lammas, and three other varieties of red wheat, have the property of tillering more than any of the others compared with them, and that the red Lammas is the best of all.

CULTURE OF CROPS INTRODUCED IN THE SIX-COURSE ROTATION, ON CLAY SOILS.

I commence with *Beans*. The most cohesive soil will suit them.

I assume that the wheat stubble had been deeply ploughed, and well water-furrowed in the preceding autumn, and is sufficiently friable in February, from frost,

to be easily harrowed down; that short manure has been carted out and spread on the ground, and then ploughed under.

Adopting the Berkshire mode in the first instance, the ground is now to be measured to women in stitches, or any subdivisions of the piece to be sown. The women having stretched lines, commence dibbling, making holes eight inches apart, and dropping as nearly as can be, three or four beans into each hole, with the left hand; having planted a row, they shift the line sixteen inches from the first course, and go on as before. A light seed or bush harrow covers the seed. Six women will set an acre of beans by this method.

The Scotch system is different, and in localities where the early part of the year is severe and spring vegetation late, and a thorough pulverization of the soil by horse-hoeing a paramount object, it is a good method. Manure being laid in rows, and sufficient for five or seven drills at each side, let these be formed as for Swedish turnips, at the distance of twenty-seven inches, and before the manure is forked into them sow the beans, for otherwise the drill-barrow, from which the seeds are dropped, could not move freely. Sometimes, when the regular drilling may be impeded by wet weather, the drill-barrow is pushed along in every third furrow as the plough proceeds, and the seed, covered by the next furrow slice, comes up in rows at equal and proper distances. By this method the horse-hoe has room to work, and complete pulverization, so requisite on cohesive land, is produced. By the Berkshire method the hand-hoeing and weeding can be effected, though the loosening of the soil is imperfectly done; but the more regular distribution of the seed by dibbling gives it on the other hand the preference.

The sort of bean sown is the white-eye horse-bean, and the quantity of seed to the acre by either of the foregoing methods is about three bushels. The Russian bean is often sown in October, and ripens earlier than the other, which is an advantage if the land requires much working and cleaning before the season of wheat-sowing. But

the spring variety, though it may not yield so much as the other, is more marketable.

The bean plants, when two or three inches high, or before, should be harrowed if the ground be hard, as this operation moulds the plants and facilitates the hoeing.

Hand or horse hoeing begins when the weeds are up, and these must be removed by cutting them out and applying the fingers where the hoe fails. In the Berkshire method of hand-hoeing, the hoe generally cuts deep enough to reach the roots of the weeds; by the Scotch method both the fingers and the hand-hoe are in exercise after the horse-hoe has done its work, between the rows of plants.

Oat-sowing.—The preparation for this commences in spring, as soon as the turnips have been cleared off, and the plough can be introduced. The middle of March is the average season for sowing; but if the weather be severe and the ground wet and cold, it is better to defer the sowing a little longer. Indeed, it is always better to wait for a favourable season than to *force* or anticipate it.

One ploughing will be sufficient to incorporate the droppings of the sheep with the surface soil and to render it loose enough for oats, which does not require much tilth of the ground, though this grain is grateful for it. The most usual and expeditious mode is to sow the seed upon the roughly ploughed surface, and harrow it in until the land is quite pulverized. A perfect furrowing with the spade concludes the process.

The sowing of clover follows, as in the ordinary Norfolk rotation with barley. If the drill machine can work, a preference to drilling the seed should be given.

Mr. Adnam, an extensive and very practical tenant-farmer in Berkshire, finds that dibbling oats eight inches between the rows and six inches between the dibbles enables him to afford employment to women, in the proportion of seven to the acre, with some little advantage to himself from the saving of seed by this mode, and the facility of twice hand-hoeing the land. Where there is a superfluity of labourers, this mode is to be urged as

satisfactory to a country gentleman, on a minute scale of cultivation, who is enabled thereby to employ more than a very limited number of workpeople.

The relative quantities of seed which Mr. Adnam gives to the ground, and the number of grains for each hole, are as follows:—

Of wheat, if dibbled from the middle of September to the middle of October, from four to six grains. If later sown he increases the allowance, according to the advancing season of the year.

Of barley — about six grains, it being difficult to drop the grains accurately.

Of oats—at least ten grains.

He has dibbled on a small scale, harrowing the land well before the dibble, and giving one or two tines afterwards to cover the seed.

The results of this dibbling for three years, compared with those of drilling and broad-cast sowing, are these:—

The first year the drilled wheat produced most, the dibbled next, the broad-cast least.

The second year the dibbled produced most, the broad-cast next, the drilled least.

The third year the dibbled best, the broad-cast next, the drilled least.

So much depends upon causes over which human power has no influence, that no certain inference can be drawn as to the positive superiority of any of these modes of sowing.

An objection to dibbling corn has occurred in Mr. Adnam's case, arising from the greater havoc made on the plants by hares and rabbits, which bite off the bunches of blade as fast as they come up, and injure the plants also by gambolling between them.

I have seen, on an agricultural farm, in the neighbourhood of Rennes, wheat dibbled in rows eighteen inches apart, and sixteen inches from hole to hole, with such effect, that many distant farmers were following the example afforded on that farm, and by adjacent farmers, who found that they had a produce of nearly one-third more

than under the old broad-cast system, besides a prodigious saving of seed, and the power of hand-hoeing effectually. The number of grains put into each hole was from fifteen to twenty, but such agglomeration of seed is not, I think, defensible on theory, and I have no doubt that one of the modern contrivances for depositing the seed singly and within two or three inches of each other, is in accordance with the right principles of sowing, and with the physiology of growth. The difficulty of distributing the seed evenly has been the real obstacle to a correct and economical mode of seeding the ground. Dibbling is, however, very conveniently practised on a minute scale of husbandry, and its superiority to the broad-cast, and even the ordinary drill method, is so obvious to the rural labourers in my present neighbourhood, that though of a class slow to adopt innovations, they invariably dibble their wheat in their garden allotments. Perhaps one of the greatest advantages derivable from dibbling oats on a clay soil is the additional harrowing and rolling which the land receives to prepare it for the operation; the rough and slovenly treatment which land so often receives for oat-sowing is thereby obviated. Of course the dibbled crop is the better for that treatment, irrespective of any intrinsic excellence in the operation of dibbling.

The varieties of oats from which selections may be made are very numerous.

Mr. Carroll, a correspondent of some of the principal agricultural publications, and a practical agriculturist of many years' experience, communicated to the "Irish Farmer's Magazine" the results of the relative produce of fourteen different kinds of oats sown on a poor shingly soil. As Mr. Carroll obtained the first prizes for the best samples of oats exhibited at the shows of the County and City of Cork Agricultural Association, his record of experiments is entitled to respect. I exclude from the list four sorts which yielded very inferior produce:—

No. 1.—Dun (winter, sown in Oct.)	produce,	24 to 1
2.—*Hopetown* (sown in April)	do.	28 — 1

No. 3.—Black Cumberland	(sown in April)	produce,	26 to 1
4.—True Tartarian, black	do.	do.	20 — 1
5.—White Cumberland	do.	do.	15 — 1
6.—Poland	do.	do.	18 — 1
7.—Common Potato	do.	do.	20 — 1
8.—Early Angus	do.	do.	22 — 1
9.—Early Kent	do.	do.	20 — 1
10.—Early Essex	do.	do.	21 — 1

The straw of No. 2, from five to seven feet long, did not fall. No. 10, very long, fell a little. No. 3, from three to four feet long, fell considerably. Mr. Carroll, after the subsequent experience of several years, considers that the foregoing standard requires no modification. No. 1 is properly a winter sort, and under the name of "Tawny," from its peculiar colour, it is now largely cultivated in Ireland.*

Clover follows, ordinarily, as in the former rotation; but on very stiff land the most approved preparation of the clover-ley, in the fifth year of the course, is to rib, or rather plough it immediately after one mowing in June; to let it rot for a few weeks, and then, after harrowing it down, to plough manure into it. Wheat concludes the course, which, however, admits of variations, such as the substitution of parsnips or cabbages, in some proportion, in the division usually allotted for turnips.

The Culture of the Parsnip.—Though the soil most appropriate to it is a friable loam, such as suits the carrot, it will grow well on cohesive soil if ploughed deeply in the previous autumn. Its success will in a considerable measure depend on the pulverization of

* Stephen Radcliff, Esq., son of the Rev. R. Radcliff, an enthusiastic amateur agriculturist, and nephew of the late Rev. Thomas Radcliff, formerly Secretary to the Royal Agricultural Society of Ireland, and author of "The Agriculture of Flanders," is reputed to have induced the extended cultivation of this oat throughout the east and south of Ireland, from his introduction of it into the county of Wexford, where it is largely sown. Mr. Carroll says that though he had introduced it into Ireland, he had written against its adoption, but was happily overruled by the zeal of Mr. Radcliff. It ripens very early, and has withstood the blight which has so frequently destroyed all other sorts. Some of my readers may try it as a spring corn, but on a small scale.

the land. All the farm-yard animals will eat it greedily when accustomed to it. It is calculated that the produce of thirty poles, if the crop be good, is sufficient to fatten a bullock in three months. The Guernsey or Jersey kind is the best for cattle. Milch cows are fed upon it in those islands, during the winter, with hay, and a good flavour is imparted by it to the milk and butter. Parsnips are useful too for fattening pigs and assisting in the keeping of poultry. But this root is not here recommended in preference to the Swedish turnip for general field culture, but for the special objects just stated, for, among other objections, thetime of sowing (from February to March) is inconveniently early, and may interfere with other farm-labour of great moment at that period. But an acre, or half an acre, may be very advantageously occupied by them.*

The Culture of the Drum-head Cabbage.—The seed should be sown in August in a seedling bed. Where a portion of the turnip division may be unfit for Swedes, these hardy cabbages would probably succeed, and they always are useful to supply deficiencies. The plants should be put down four feet apart every way, to allow ample room for a deep stirring of the ground with the fork or hoe, to enable the fibres to strike out freely. The more the land is loosened, the more are the roots or *mouths* of the plants multiplied and strengthened. Though very inferior to vetches or clover as food for milch cows, cabbages are useful at a later season; and if steamed, more particularly, they are not only eaten with avidity by cows, but are perfectly digestible. Cabbages have more of the elements of nutrition than is commonly supposed, if they be close and firm in the head, proving solidity by their weight; but mere leafy cabbages, like those of the winter-kale sorts, are inadmissible. When steamed and mixed with pollard or bran, drum-heads are very nutritive for

* To have good seed, some of the largest and straightest roots of the Jersey sort should be selected and put into the ground in spring, at the distance of two feet from each other, in a sunny and sheltered aspect.

store pigs also; but if the ground be in a good state for Swedes, do not displace any of them for cabbages.

Vetches.—This is a valuable green crop to vary the regular course. It should be sown in September, on wheat stubble intended for turnips; or in August, intervening between early potatoes and the following spring crop. If you want to cut them green, manure previously; if you sow for an early bite for sheep, the land will be clear for the usual rotation. The renovating influences of vetches cannot be too highly prized, if fed off by sheep preparatory to a crop of wheat.

One of the best effects of vetches is its power of overshadowing the ground, and thus preventing evaporation from it, and the growth of weeds.

If the crop be for *soiling*, the seed should be sown at intervals of a fortnight to come in succession; and it is judicious to have a cutting of vetches between the first and second mowings of clover. They supply a capital substitute for clover, when it is desirable to omit this in any measure, during either the six or the four-course rotation.

They are excellent for causing in cows the secretion of milk, and they do not produce the flatulence which is so often occasioned by clover.

It is important to have the power of obtaining two crops in the year, by sowing vetches, as above stated, either after early potatoes, or on manured stubble land after harvest. The detailed operation will be seen in the routine work to be executed in September.

The winter and spring vetches are botanically distinguished: the former pushes forth a green seed leaf; the latter produces its first leaf of brownish hue, and of spear-like form. Until the blade appears, the distinction of seed cannot be ascertained; therefore it is prudent to save one's own seed. From two and a half to three bushels of seed is sufficient for an acre, if the land be perfectly clean and in a fertile state.

While on the subject of variations in the regular British crops of the several rotations, I may here introduce what may be necessary to detail with regard to

Potato Culture,—of the late kinds, constituting the main crop, which, from proximity to a profitable market, or any other causes, it may be expedient to have on a considerable portion of the root-crop division.

The culture of the early kinds, produced in much smaller proportions, and requiring for their perfection sandy and loamy soils, is not under present observation, but shall be treated of when I arrive at the part of this little book in which the surplus ground, not included in the forty acres of regular farming, shall be apportioned for management.

Though there are objections to potatoes from danger of blight, and their supposed exhaustion of the soil (which is, I think, an English prejudice of the imaginative kind), and from their being carried from the ground instead of being consumed on it, as generally in the case of turnips, they are so valuable an esculent, and so profitable for the market when they do not fail from the disease which of late years has affected them, that they have strong claims to be admitted among the green crops, which from the *culture* bestowed upon them are improvers of the condition of the soil.

As to the objection that they are not consumed on the land which produces them, this would equally militate against Swedish turnips, cattle-beet, carrots and parsnips, which are drawn for feeding animals in the farm-yard; and a little additional manuring, to compensate for any excessive or disproportionate abstraction from the soil of its alimentary elements, will at once equalize its productive qualities. As I know from my own observation that wheat and barley have commonly followed in immediate succession after well-manured crops of potatoes in Ireland on the same farms, without exhaustion of the soil (if naturally of good quality), during a long term of years, I cannot believe that the *occasional* substitution of potatoes for turnips, and when only one cereal crop is to intervene between it and clover, can impoverish the soil in any degree. I should be sorry to *rent land* that would require even a homœopathic supply

of manure after potatoes sufficiently manured and tilled, preparatory to any cereal succession.

But I am far from supposing that turnips followed by sheep-feeding or used for stall-feeding should give way to potatoes or any of the other root crops enumerated; but I would admit an acre or two of any of them in association with the turnip.

When and how, then, shall we plant the potato crop?

About the first of April will be quite early enough for planting them.

The work proceeds thus:—The ground being deeply and thoroughly ploughed twice, and pulverised by a long tined harrow, open drills, as for Swedish turnips or cattle-beet, from thirty inches to three feet or even more apart, according to the probable height and foliage of the variety to be planted, but not of such width as would encourage excessive luxuriancy in these respects; for the results would probably be deficiency in the farinaceous quality of the tubers and of solidity in their central parts. But in very thin soils the breadth must necessarily be much greater than it need be in deep ones, from the necessity of having a larger area from which to accumulate the necessary quantity of mould for earthing up the plants. And in land of this character, the sorts of potatoes should be planted which have a tendency rather to rise in the earth than to sink into it, and which receive a direct benefit from having the ridgelets as high as possible. The manure should be deposited in equi-distant rows, about twenty-one feet apart, and in such quantities as will allow the labourers, as in the drill Swedish turnip culture, to fork it with convenience into four or five drills at each side of the row. The drills being opened, the setters lay down either whole tubers or cut sets, the former sixteen inches apart, the latter nine; the dung is then carefully laid over them, and covered as in the operation of finishing large drills generally, the furrows being swept by going down and up the first furrow, down the second, up the first (the third turn), down the third, up the second

(which finishes without leaving a track of the horses), down the fourth, up the third, and so on.

The concluding operation is to rake the drills flat, to press down the manure and cover it completely, and prepare an even surface for the rising plants.

Since the visitation of Providence upon the potato, and consequently upon the multitudes which subsisted upon it, by that disease, the origin, progress, and diminution, of which is a hidden mystery, into which physiologists and philosophers, real or empirical, have vainly inquired, it has become usual to plant entire tubers, as more likely to resist incipient decay in the rudimental stage of vegetation, in their integral state than when divided into parts.

In briefly discussing the question whether whole or cut tubers are preferable, I have before me the details of an experiment made many years ago, by Mr. Robertston, formerly of Kilkenny, who was eminently scientific and practical, and I have no doubt of the accuracy of the test, and of the report.

No. 1.	Two drills planted with cut sets (red apple), of two and three eyes each, nine inches apart,	produce	83	lbs.
No. 2.	Two ditto, ditto, twelve inches apart,	,,	77	lbs.
No. 3.	Two ditto, ditto, sixteen ditto,	,,	71	lbs.
No. 4.	Two ditto, whole tubers, nine inches,	,,	80¼	lbs.
No. 5.	Two ditto, ditto, sixteen ditto,	,,	86	lbs.

Thus the whole tubers, at sixteen inches distance, gave the greatest produce; and that, too, with very little more seed used than if they had been cut into good sized sets, planted nine inches apart,—the ordinary distance.

It is useless to enumerate varieties of the middle season, and late crops of potatoes, as new seedlings are perpetually coming into existence under local names. Some conception of their numbers may be formed from the fact that Mr. Lawson, curator to the Highland Society, exhibited no fewer than sixteen hundred kinds in the year 1837; and their prolific qualities may greatly depend upon the soil and climate. The quantity and the quality of potatoes, even in soils of the same constitution, vary so

much, that no grower of a kind which may flourish in one part of the kingdom can be sure of their succeeding elsewhere. "Potatoes," observes Mr. Towers, "which are excellent in West Wiltshire—as, for example, the varieties there termed the Early Purple-eyed, and the Prince's Beauty—have deteriorated in Berkshire, treat them how you may. Lancashire is famed for its varieties, which boil to a meal that crumbles under the fork, and is nearly as white as flour; but the varieties change in the midland and southern counties."

Having, I hope, with sufficient clearness, though necessarily in a very succinct form, exhibited the most approved rotations of modern husbandry, on the regular farm portion of the land, I must treat a little of the irregular culture admissible on the surplus portion of the land, whether in lawns, paddocks, or small experimental fields.

Here, rather than in a very sheltered garden, I would have a few beds or drills of early potatoes, such as the Walnut, the Early Champion, the Early Shaw, the Forty-fold, the Regent, and the Early Cumberland.

The culture of early potatoes differs from that of the later kinds in requiring less intervals between the drills, if they be drilled, greater care and neatness of tilth, and manual labour in a greater degree. Freshly broken ley ground is the best for them, as indeed for potatoes generally, and the spot assigned to them should be exposed to the sun, and sheltered from the north and east, the frosts of May being often sadly destructive of the first leaves, unless a frame-work with some simple covering be prepared to protect them. The process of preparing the ground may be described in a very few words. The practice of the late Mr. Knight,* a most successful cultivator of potatoes, was to set whole tubers of early sorts and therefore small sizes, such as the oak-leaved kidney, in rows, within two feet of each other, and not more than four inches apart in the rows, with the crown-end uppermost. Mr. Towers's method was to plant the tubers in

* President of the Royal Horticultural Society.

trenches, about eight inches deep and twelve wide, the excavated earth forming an intervening ridge. Into these trenches he dug three or four inches of half-rotted stable dung, with leaves, used for linings; mould was then raked over the dung to within four inches of the surface; about an inch of earth, with a little sifted ashes over it, was the depth of covering over the tuber at first; dry litter was laid as protection against frost.

To insure the preservation of either whole or cut tubers from injury arising from the humidity of the soil in the very early part of the year, suppose in February, the old Irish method of setting them on a lazy bed or ridge of fresh-dug or ploughed turf, about four feet wide, is the very best; and the crop so raised will be earlier by some days than if raised in drills. The sets should be laid twelve inches asunder every way, on dung spread over the bed, and covered about two inches with mould from the furrows. When the stems and leaves appear at the surface, a light earthing from the furrows should be given to defend them from frost; and this operation should be repeated as they rise up, and while any mould can be obtained by digging the trench at each side. The rapidity with which the plants rise immediately after this moulding, and the preservation which they receive from light frosts by this earthing, are hardly credible to those who have not witnessed the effects of it. Gardeners raise sea-kale in similar beds, with deep trenches; and it is an axiom, that the neatest and most perfect field husbandry is that which most nearly resembles garden culture.

Long observation of the nature of the potato has convinced me that disturbing the root fibres, by the too close approach of the hand-hoe or paring-plough, is not suited to their organization. The treatment which causes the roots of the cabbage to strike out its feeding-fibres more freely, and multiply its powers of extracting nutriment from the soil, will not, I think, succeed with the very delicate root-fibres of the potato. But I do not mean to advocate the Irish ridge-and-furrow system,

except for very early potatoes at an early season; on general principles it has been long since very properly abandoned by all good farmers.

The early potatoes may be succeeded by borecole and Savoy plants, planted in July, when showery weather will favour their rooting. The ground should be deeply forked for them, and moist dung applied to their roots. These cabbages will be serviceable during the winter and early spring, when vetches may succeed them with great advantage.

A piece of spare land will always be found convenient, if it were only for trying experimental culture on a minute scale, without derangement of the fixed routine on the arable farm generally. Comfrey (*Symphytum asperrimum*), introduced into England from the Caucasus towards the the close of the last century, will, it is confidently said, produce on dry soil, though poor and unsheltered, a very heavy crop. You may try this then on your reserved portion of land. The season for planting it is February and March. The plants are propagated by cutting the roots into small pieces and placing them in drilled rows, from three to five feet apart, according to the quality of the soil. It comes into use early, and would therefore succeed the turnip crop as food for sheep or cattle, to which it is very palatable. It may be spread on a pasture-field for them, or carried to the sheds and stalls. The reports of its weight per acre are, in some instances, almost fabulous; but that of Mr. Grant, of Lewisham (who brought it into prominent notice fourteen years ago), is moderate,—thirty tons per acre. Mr. Grant cut it three times in the year, and thus sums up his character of it in a letter to Lord Farnborough:—"It will grow in all soils and situations; it may be planted by the sides of ditches, in any waste corner of fields, orchards, gardens, &c.; it is a vegetable that no one can lose by, as the only expense is the purchase of a few plants in the first instance; it may soon be increased to any quantity, and when once established I believe it will last for ever. I never knew a plant to die, and I know some that have

stood more than twenty years, and are as full of vigour now as they have ever been. I have no doubt, that in a few years it will be cut and carried in bundles, and sold about the streets of great towns as tares, rye, clover, &c., now are, as it comes before, with, and after them; and the produce being so enormous, and the expense so trifling in comparison with all other crops." Manuring heavily would undoubtedly be required at some intervals of time, to repair the exhaustion which such luxuriance and frequent cuttings would induce. I have known osier-beds to fail entirely in twelve years from want of the application of fertilizing substances. Comfrey, of such rank vegetation, is not likely to be an exception to a general law in all analogous cases; but such a vegetable would be well worth manuring if it be all that is here represented, and that I have read or heard from other respectable sources also.

Both lucern and sainfoin are (if the soil be suitable) especially appropriate to some portion of the surplus acres for which we are now arranging the crops.

These valuable perennial grasses, which, in deep, loose, and *calcareous* soils, afford larger produce than any sorts known to us, are well known and justly appreciated on the chalky lands of Kent and elsewhere; but there are many other localities, not of chalk but yet calcareous loams, and deep dry lands, and somewhat gravelly soils, in which one or both would thrive, and yet where they have not been even introduced to notice. Of sainfoin I cannot say anything from much observation; I have seen it in Kent, and in parts of France, preferred to lucern, though I believe that the soil which is appropriate to the one is good for the other. Perhaps sainfoin will better resist the droughts of a chalky soil than lucern, but both are tap-rooted and perennial, and root very deeply in search of food. Of sainfoin, Sir John Sinclair said, "It is one of the most valuable herbage plants we owe to the bounty of Providence." Its nature, qualities, and treatment, are so nearly identical with those of lucern, that I shall confine any further remarks to the latter.

The Culture of Lucern.—Any deep loam, hazel mould, or even sandy soil on a sound and free bottom (calcareous the best), is suited to it. It should never be sown on wet or clay land, for there it must always disappoint the cultivator, who will find red clover, if he treats the land properly, far superior. The land should be well prepared, very deeply dug or ploughed, if you will do the work in the most effective manner—and a previous turnip crop will have been the best preparation—but whatever may have been the preparatory cleansing crop, the ground should be perfectly clean; and as lucern is especially one of the lime plants, burnt chalk, or lime in some form, should be mixed with the soil, if not naturally calcareous, at the commencement, and periodical top-dressings of it afterwards administered.

After harrowing the ground, the seed will be best sown in drills, sixteen inches apart, which will admit the scarifier in the subsequent treatment. But where such an implement is not available, a small triangular-shaped hand-hoe will effectually clear the plants of weeds. The season for sowing is the beginning of April, and it is better not to sow any barley or other grain with it; if the temptation to do so be irresistible, a very thin corn seeding should be made. Twelve pounds of lucern seed, regularly distributed, suffices for an acre. In the following year it will be from two and a half to three feet high at the end of May, and will bear cutting three and even four times, allowing intervals of six weeks between each cutting. The flowers, which are of a bluish or violet colour, appear in June. In France and Switzerland, and other parts of the Continent, lucern has long been a favourite, and would be perhaps more esteemed in England, in the soils adapted to it, but for its interruption to the established rotations, and from the far more general suitability of clover. But where a portion of appropriate land can be exclusively given to it, it ought to be cultivated. The weight of produce, where it succeeds, is greater than that of red clover, and it is a more nutritive and less flatulent food for cattle, and makes admirablo

hay. The late Mr. Dombasle, one of the most eminent French agriculturists, unfortunately, has not estimated the proportions of nutritive elements which lucern contains relatively with clover or sainfoin, though he has taken it as his standard of comparison as regards various plants. It appears from his tables that lucern has less than a third of the nutritiveness of carrots, and more than half that contained in white beet. It should never be grazed, especially by sheep or horses, which would bite the crowns out; but it is worth protecting in a compartment by itself, when completely established.

GRASS LAND.

Your lawn must be under grass, either grazed by cows or mown for hay. The haymaking has been already dismissed, the other subject now presents itself.

As you are probably neither disposed to, nor under the necessity of observing that rigid economy in rural management which leads us to keep cattle and other animals in some sort of imprisonment, to consume the farm produce in the most profitable manner, as regards the accumulation of manure—for I suppose you can buy any of the various artificial manures, now procurable everywhere—the cows may be permitted to enjoy their liberty during the summer half-year on the green turf. The sight of a beautiful cow reclining under the shade of a tree in full foliage is very pleasing; and the gambols of the favourite horse, just freed from harness or the saddle, rolling on the sward, or kicking up his heels with the gleesome spirits of a schoolboy emancipated from study, are exhilirating in our contemplation, and worth the sacrifice of the blades of herbage which they trample upon.

Is your pasture-ground in unsound and infertile condition? Does the detestable crow's-foot (*Ranunculus acris*) abound in it?—it is in a diseased state,—there is stagnant water beneath; and though this weed, under the gaudy appearance of "butter-cup," looks pretty, do not be fasci-

nated by its bright colour, for it is one of the most noxious and distasteful of the natural grasses to cattle. Do rushes in any degree appear? then you may be sure from such indications that draining is necessary. Do this then at once, and afterwards give a dressing of lime or calcareous substances of some sort; even lime-mortar, or any rubbish containing it, with silex in abundance, will be serviceable in causing a better order of grasses, even white clover, to grow in the improved condition of the soil.

But I may suppose that your herbage is generally of a bad quality from other causes than that of a close undersoil requiring drainage. In this case, turn cattle and sheep to eat it down early in the season, else they will not touch it when better grasses grow up. It is not necessary to have a full bite at first, especially after dry winter fodder; for the deficiency of luxuriance in the pasturage on their first transition to soft green food, is advantageous to cattle, by accustoming them gradually to succulent food. About the beginning of May cows in the midland counties may, on average of situation and seasons, be turned to pasture. The quality, too, of the pasture, as much as the other conditions, must determine whether it ought to be fed off early or late. For instance, newly-established pastures of such grasses as you wish to establish in the ground, should not be checked in their growth by premature cropping. If fed too bare, the vigour of such plants will be impaired; they should be allowed to make some progress to maturity. If checked in the spring, by the destruction of the crowns, they will not push forth a full succession of blade. But where coarse herbage abounds, the object is to diminish or destroy its vegetation, and thereby make way for better grasses. The premature grazing of such defective plants then, by animals too hungry to be fastidious, is the best mode of making them disappear, and give place to a better order of grasses.

If draining, manuring, and the close cropping of the herbage do not alter its unfavourable qualities, the paring

and burning of the surface and the sowing of suitable seeds is the most effectual remedy. The introduction of a variety of animals of different tastes and appetites is useful in eating down bad pasture closely, and improving it, without the necessity of breaking it up, which is the last resource in the case of a lawn or paddock.

The cow will eat plants which the horse rejects while it has the power of selection; the sheep has its tastes too, and follows closely after the teeth of the others; and the donkey is of such accommodating taste that it relishes as a luxury the thistle, which is despised by its graminivorous associates. By thus feeding off then your inferior grasses, by different classes of animals, and by successions of them, you will improve the quality of the herbage, if you do not add much to its fertility. The close biting of sheep tends more than any other treatment to improve the texture and general quality of pasture-land. The folding, too, of sheep, on turnips thrown on the turf, will tend to its amelioration. In feeding off, however, grass under the supposed circumstance, do not mingle cows, horses, and sheep together, as they are apt, from their respective habits, to interrupt the enjoyment and repose of each other. Horses and cows do not associate pleasantly together, and the latter sometimes bayonet the others with their horns. A sound loam, in which good herbage is established, will not require breaking up if judiciously fed, occasionally mown, refreshed with hay-seeds, top-dressed, and kept free from intruding weeds, some of which, by the way, such as the thistle and ragwort, are evidences of sound land, and so far not absolutely unwelcome, though they should be extirpated. Most of the dock family are annual or biennial; the common field and sow thistles are perennial, and if mown closely when about to blossom, and well salted, will disappear. The repeated close cutting of the stems will destroy many weeds; the weeding irons will remove others; the ragwort is easily pulled out of the ground altogether.

If draining, judicious manuring, and close grazing will

not banish those weeds, it will be advisable to pare and burn the surface.

PARING AND BURNING.

The paring off the grassy surface with a spade or plough, in order to convert it into ashes, has had many opponents. The advocates for it maintain, that any loss of substance is more than repaid in the improved quality of the soil, and of its productions. The alkalies that are produced from the consumed plants, of a coarse and even injurious nature, powerfully tend to promote the growth of new and valuable herbage; and the reduction by fire of such plants as heath, furze, tough wiry grasses, rushes, and moss, which is the plague of many pasture fields, into powdery carbonaceous matter, is, under the high authority of Sir Humphrey Davy, serviceable, and the cheapest and most expeditious means of reducing such substances to a state of minutely divided particles, which can at once supply with food the roots of new plants. The practice has been abused in many instances, not so much even by repeated burning, as by the excessive cropping and exhaustion of the soil afterwards, and too much dependence on the ashes alone as the elements of manure from the succeeding crops. It is an error to suppose that the soil is consumed, with the vegetable covering and its roots: the intermingled earth is only calcined, the staple of the soil therefore is not diminished. The destruction of grubs and insects by the process of burning is not the least useful result.

Paring with a breast-plough, from an inch to an inch and a half deep, is hard work to a man's arms, thighs, and breast; yet men are anxious to be so employed at piece-work. But a horse-paring plough executes the work also in a very complete manner. It can turn over a furrow from twelve to fifteen inches in breadth, and one inch in thickness. If you cannot hire or borrow this, you must employ men to do the work. In ordinary

early summer weather, the sods will be dry enough in a fortnight for collecting in heaps and burning, after previous care to turn and expose them to the sun in the most effective manner. The sooner the ashes are spread and lightly ploughed in, the better. This is an excellent preparation for turnips; but the addition of *guano*, bone-dust, or superphosphate of lime, is not to be omitted from any parsimonious principle. This extra expense will be paid in the value of the turnips. You will, no doubt, in the following spring, lay down the field again, if it be your lawn or park, with grasses along with barley or oats.

If you are anxious to have this land in turf as quickly as possible, there is nothing to prevent the paring and burning in April, and the ploughing and harrowing of the ground immediately, for the reception of grass seeds without a spring corn crop. Where such rapidity of result is not an object of anxiety, the cultivation of the land by turnips, followed by barley, is preferable.

The principal grasses for permanent pasture on heavy soil are—

Meadow Fox Tail (*Alopecurus pratensis*).
Meadow Fescue (*Festuca pratensis*).
Cock's Foot (*Dactylis glomerata*).
Crested Dog's Tail (*Cynosurus cristatus*).
Rough-stalked Meadow Grass (*Poa trivialis*).
Timothy Grass (*Phleum pratense*).
Perennial Rye Grass (*Lolium perenne*).
Perennial Red Clover Cow Grass (*Trifolium pratense perenne*).

For light and medium soils—

Meadow Fox Tail.
Larksfoot.
Meadow Fescue.
Meadow Cat's Tail.
Perennial Red Clover.
White Clover.

There should be no penurious saving of seeds, as the whole surface ought to be thickly covered with them.

However, three bushels per acre may be set down as the *maximum:* ten pecks is a very sufficient allowance. The proportions in which the seeds should be mixed may be left to the discretion of any seedsman of experience and reputation for integrity and judgment. Some seeds should be sown in greater proportions, such as the rough-stalked meadow grass, the cocksfoot, the meadow foxtail, and the meadow fescue, either from their very nutritive properties or early growth, or some other peculiarity of a useful kind. Some, such as trefoil, though good for two years, perish afterwards; and yet as intermediate occupiers, until some of the tall and leafy grasses are established, they are useful. In sowing grass seeds, three points are to be specially considered, viz., the length of time during which the land is to be occupied by them; the purpose for which the grass land is to be applied; and its condition and quality. On ground intended for permanent pasture, it is obviously unwise to sow short-lived grasses: in such case, the perennials which are found to abound in the best old pastures of soils of analogous qualities should be chosen and proportioned accordingly. Our efforts should be to imitate the bounty of the Creator in supplying the appropriate kinds for a permanent pasture, and to combine the new plants in such proportions as nearly as a careful analysis of the grasses of any given area of good sward will permit.* Such good grasses, then, as experience proves to be congenial with the soil, should be selected. Some of the indigenous grasses are the very best. And where there is a strong tendency to their growth, those of good quality will, in the course of time, spontaneously appear, and perhaps struggle successfully with the artificially introduced plants for possession of the soil, and at length constitute an excellent sward when the others have disappeared, from incongeniality of soil or other causes tending to render them but short-lived occupants. "An important law in the natural economy of the grasses governs all those species of most value to the farmer; viz., individual plants of

* This has actually been done by Mr. Sinclair.

the same species will not grow close to each other for any length of time; for however thickly planted from seed, in one or two seasons intermediate plants decay, and leave vacant places which are soon filled up with spurious grasses, weeds, or moss; but when a variety of different species, adapted to the soil, are mixed intimately together, they grow close, form a dense bottom, and continue permanent." On land prepared as we have been assuming this to be, by paring, burning, and tilth, the seeds ought to establish themselves soon: all they require is to be sown under the bush-harrow and rolled.

LIVE STOCK.

Horses.—If you keep but a single pair of these for every sort of work, half-bred horses will be found the most serviceable. No horses are so enduring, or more hardy, than those which have some high blood in their veins; their energies carry them through work under which the sluggish cart-brute, of ignoble breed, would fail. Horses that will travel well in light carriage harness, or with the saddle on occasions, will have an active step under the cart, or with the plough at their heels. Even one such horse will be very efficient to the cultivator of a diminutive farm,—from ten to twenty acres,—in carting out manure, drawing a seed-harrow, rolling, drilling seeds, earthing plants, horse-hoeing, &c.

Some of the local breeds of horses are so good that it would be presumptuous and absurd to point out any peculiar class of them for your purpose; if, however, I were choosing for myself, I should select the Suffolk breed: they combine sufficient activity of movement with good size and *weight*, which for draught, on heavy soils in particular, is such an essential qualification. For the small farm, and the phaeton too, a breed that is neither too heavy nor too light in the shoulder, with limbs neither clumsy nor thin, and of dark colour, well ribbed,

and without the heavy paunch of the mere cart-horse drudge, with short pasterns, moderately-sized hoofs, good hind quarters, and full breadth over the loins, and not exceeding fifteen hands in height, is quite suitable. If a horse possesses such points it is indifferent what its colour may be, for, according to the proverb, "a good horse is of any colour;" though those of chesnut colour, it is considered, are less hardy than those of dark brown or bay,—and there is some foundation for this opinion.

The same person should be ploughman, carter, and groom, and as gentle and good-tempered as you would wish your horses to be. Nothing is more tormenting and confusing to the docile and sagacious animal than a change of the controlling hand and voice. It is of as much moment that the horse should understand the man, as that he should become familiar with its peculiarities of temper and habits.

Stable Management.—The few remarks I shall make on this point will apply to the horse more in its character of a farm hack than in that of one kept for show, pleasure, or much road-work. A frequent error in feeding farm horses is that they are stuffed with hay, and fed sparingly with oats. The man who has the care of them, in order to save himself trouble, or from mistaken kindness, fills the rack with hay each time that he goes up to the loft, or brings hay to the stable from any other place, and the consequence is that much of it is pulled out, rejected, and trampled under the horses' feet, or left from one day to another under the polluting influences of their breath.

To avoid this waste I would, in the first instance, either dispense altogether with a rack (substituting a box-manger for it), or have one incapable of holding more than fourteen pounds of hay. If the hay and straw, too, be cut into chaff, the rack is obviously useless; and the advantage of giving chaff instead of uncut fodder is considerable in respect of economy; and if it be mixed with corn the mastication of every grain

is thus insured; and what is of great consequence, by mixing corn or beans with the chaff, the stomach is filled in the course of an hour or so, and the horse can lie down, or at least sleep, instead of standing up and pulling at the hay for hours to satisfy its appetite. But this food alone is not sufficient; there should first be given (in winter feeding) a mess of steamed carrots, potatoes, or Swedish turnips; or if these be not available (or even if they should be, as a change of dietary), there may be some boiled barley or bran. If the horses are not at the time engaged in slow farm-work, but wanted for quick road-work with a carriage, the soft food should be given in very limited quantities, if at all—then the quantity of oats, with or without a little beans, should be increased; but in no case, with *sufficient* corn and roots, in whatever proportions distributed, ought there to be more than fourteen pounds of hay and a few pounds of straw at the utmost given in the twenty-four hours. I once visited the late Mr. Rennie, of Phantasie, in Scotland, and I saw that he, who was a highly distinguished farmer, had the quantity of hay, which was very small, considering the size of his horses, weighed out, and tied into bundles every day, so that the carters or ploughmen received in the evening the due portion for each pair of horses, and were therefore restrained from giving them too much of it; a warm mess of grains or something of this sort invariably was allowed also. A large animal will of course require more food than a small one.

In some of the largest establishments for horses, at slow work, 36 lbs. weight of food altogether is considered a sufficient allowance, and they are kept by it in excellent condition; viz., 14 lbs. hay, 6 lbs. straw, cut into chaff; 14 lbs. oats; or, partly equivalents, viz. beans, bran, and boiled barley.

By giving carrots, &c., abundantly, the hay may be reduced one half, and when it is very valuable for the market, the saving in this respect may be an important consideration to the economist.

It should be recollected, that "of all animals the horse

has the smallest stomach relatively to his size. The camel has cells in his stomach, store-rooms for his food, during many days of abstinence; thirty sacs have been reckoned in the dromedary's stomach."* But the interior department of the horse has no spare room whatever; and after moderate work he returns to his food with appetite, which shows that digestion had rapidly proceeded: there is an almost unintermitting progress of digestion in this small stomach, which requires therefore frequent though not large supplies of food. It has been suggested by a writer in the "Quarterly Journal of Agriculture," that for (mere farm) horses, where hay is scarce, the following dietary should be adopted:—in the morning, 3½ lbs. oat and bean meal; 11½ lbs. chopped straw—total, 15 lbs.; at mid-day, 3 lbs. oat and bean meal; 12 lbs. chopped straw—total, 15 lbs; at night, 1½ lbs. oat and bean meal; 2 lbs. chopped straw; 11½ lbs. steamed potatoes—total, 15 lbs.

Many persons have been in the practice of bruising all the oats given to their horses. I have tried it; a disagreeable smell is imparted by the iron machinery to the grain, and horses do not like it as well as if it were in the natural state. This, at least, is fact, and when taken into account with the remark of M. Houël, a French writer of celebrity on this subject, "that oats ought to be ground down and saturated with saliva, in order to be completely assimilated, and that oats in the glutinous state produce disorders in the intestines"—I give a preference to the system of mixed unground oats with chaff, which will oblige the horse to chew the grain and not *bolt* it, as a hungry one will do.

During the summer season, from 70 lbs. to 80 lbs. of lucern, clover, or vetches is an ample dietary, without any corn; oats or beans should be given where economy is quite a secondary consideration, and decidedly in the case of horses required for other work than that of the slow-going rate of field work, to correct the aperient

* Paley's Natural Philosophy Illustrated, by Lord Brougham and Sir Charles Bell.

qualities of the succulent food. Six lbs. of oats, however, are sufficient with the green food, which is the best alterative that can be given to a horse after a long continuance of feeding on hard dry food.

DAIRY MANAGEMENT.

The cow-house should be so contrived, particularly if many cows are kept, as to have a passage in front of them, wide enough for a man to pass along with their fodder, and lay it before them, without waste or inconvenience. If the building be wide enough for a double row of cattle opposite each other, a middle passage serves for each. In single sheds, a rack and manger for each animal may be easily fixed in one or more recesses in the front wall, with falling boards on the outside, which when lifted up afford the convenience of putting hay or straw into the rack above, or beet-root into the manger beneath it. Such folding doors are divided by hinges into two parts, the upper when closed forming the back part of the rack, the other that of the manger. The mangers should be moveable, for the purpose of being frequently scoured. The liquid discharges from the cattle should, as in the construction of the stable, be conveyed by a gutter into a tank: the loss sustained by want of economical arrangement in this particular is incalculable. The cow-house should be kept very clean, and abundantly supplied with dry litter.

The Breed of Cows to be preferred.—The Durham or short-horned, of the large sort, the Ayrshire, the Jersey, better known by the name of Alderney, the Hereford, the Lancashire, and though last, not least, the Devon, have pre-eminent claims. The first-named arrive at maturity much sooner than any other, are easily maintained considering their size, and are distinguished for their contributions to the pail, and yet have a tendency to fatness when unproductive in the dairy, and even at an early age are good beef. The Ayrshire is a very beautiful class; it

approaches in all good qualities nearest to the improved Durham. For the dairy alone, it is perhaps superior.

The Jersey has long and deservedly been a favourite; and the extreme jealousy with which the farmers of Jersey prohibit from importation into their interesting island, a bull of any other race, shows the great value which they set upon their own breed of cattle, and the profit they derive from exporting them of unmixed blood. These cows are admirable for the dairy, but there ends their great superiority. They are small, and badly formed for fattening.

The pretty little cow of Brittany, which may be bought there for £3 or £4, is frequently sold to inexperienced persons in the south of England, as of the genuine Jersey breed. Its silkiness of skin and perfection of form (indicating good dairy qualities), which this easily fed animal generally possesses, render it a miniature model of beauty for the cottager's cow. I have seen some pretty cows of this kind at the agricultural school of M. Bodin, near Rennes, where they have been crossed with a small Swiss bull, of very similar shape.

The Devon.—The North Devon is an exceedingly beautiful animal, and fattens readily. The cow is among the best for the dairy, in respect of richness of milk (though pasture and food generally must exercise much influence in this point), but the quantity is not great, and it is frequently objected that the tendency which this magnificent breed has to fatness renders it less desirable for the dairy than the other favourite sorts above mentioned. The Suffolk and the Hereford have their admirers also; and, in truth, a cow with the right points for the dairy may be found in any of the approved breeds, and often among those which are unknown to fame. As a good horse may be of any colour, so may a good cow be of any breed.

Dairy cows kept in close confinement ought to be fed with the utmost regularity. They should have their green food given to them, though in small quantities at each time, every alternate hour. In winter, cattle-

beet, cow-parsnip, or whatever roots may be provided, or mashes, should be given with regularity, and enough of hay at night, but never any more than they can eat up clean. This, however, applies to cows actually giving milk. A cow which has gone dry, should feed in winter more upon good hay, and much less upon roots, though just before calving succulent food in some degree may be given to her, with good effect, to assist in promoting the secretions of milk.

Supposing a cow to calve early in April or May, there is no keeping to be compared with a sweet pasture for affording the best flavoured milk and butter; therefore, although on a principle of economy I have always recommended the house feeding of a cow (as one acre of good clover will support three cows during the summer, whereas an acre of pasture will but barely suffice for one during the same period irrespectively of the manure saved by the former management), I make a decided exception where there is no necessity for minutely regarding economy at the expense of the discomfort of the cow, and the inferiority in flavour, if not in quantity, of cream and butter. Yet, even with liberty, and the animal's enjoyment of picking her food as she pleases, there will be necessity in summer for some artificially grown grasses, to supply any deficiency that may occur in the pasture, and provide for the house feeding, when the heat of the sun, the stinging of flies, or the bursting of a storm may render the shade and security of the cow-shed very grateful to your cows. In the early and cold spring, and before the grass has sufficiently sprung up, it is not any kindness to the cow, and it is a decided injury to the ground and the vegetation, to turn her out; at that season she requires the warmth which her stall affords, and the nourishment that nutritious hay and roots and bran impart.

But the lawn or park in which your house or cottage stands is, I am supposing, the only grass-ground (excepting a little paddock, in which a cow or two may take the air occasionally), with shrubs and plant-

ations surrounding it, or growing in clumps. In such case a cow may be picketed or tethered to certain limits, by a light chain fastened to an iron pin (with a swivel ring), driven into the ground and shifted from one spot to another, accordingly as she shall have eaten off the circumference which the radius of chain affords. I have known six cows kept in this way, from the 14th of May to the 18th of June, on two acres of lawn; these were regularly succeeded by sheep, tethered also. The manuring which the land received caused a daily reproduction of grass by a forced vegetation; and the dairy-maid was perfectly satisfied, as the cows gave as much milk and butter upon this uniform regimen as upon any other. Perfect liberty in a paddock by night, would be a desirable change. Before the time for keeping cows out in this way, they will have had (or ought to have had) rye or vetches, sown early in the previous autumn, as a green bite in their stalls; but good sweet soft hay should be given too, as a corrective of the aperient qualities of the green food.

No precise directions can be laid down for cow-keeping: so much depends upon the soil and peculiar farm circumstances, and also upon the wants and tastes of the occupier of the land. Near a brewery where grains can be had in winter, or with particular facilities for obtaining bran and pollard, the want of root-crops in winter and spring, will of course be diminished, or removed altogether; and as such washy food tends greatly to the increase of the milk, without tainting it in any degree, it may be the better aliment, and the roots may be otherwise applied. But it should be remembered, that such slops, while they promote the secretions of milk, diminish the *butyraceous* element. If you want cream and butter, and wish to have your cows in good condition, use cattle-beet and similar food, of a solid, nutritive, and substantial nature.

Neither can we pretend to state the quantities by weight of the different sorts of grasses, hay, esculents, &c., which a cow will consume, or ought to have. So much

depends on the quality of the pasture food, and on her size and capacity of stomach and condition.

Perhaps the calculation of the late Mr. W. Allen, one of the true benefactors of mankind, given in his "Colonies at Home," is a good average estimate daily of a cow, for 180 days:—30 lbs. yellow beet-root or mangold wurtzel; 30 lbs. turnips, carrots, or parsnips; 15 lbs. potatoes boiled or steamed, or, instead of them, an increased quantity of the other sorts; 7 lbs. oat straw, and 7 lbs. hay.

Milch-cows, whether entirely or but partially confined, should be kept clean; their hind quarters in particular should be curried and washed when matted with dirt, and indeed, at all times, when housed, they should be well rubbed with a whisp; and while they are in confinement the friction of a brush in circulating the blood and opening the pores, by removing all cutaneous obstructions and impurities, is conducive to their health. Before milking, the udder and teats should be washed quite clean. A dairy ought to be cool in summer, and therefore a north aspect is the best; otherwise, if it be shaded by trees or buildings from the sun, so much the better. Cross windows of small wire cloth are necessary for thorough ventilation, and for keeping out flies in summer, and it is better not to have any communication from the interior of the house with it, lest impure air should enter it, for nothing is more easily tainted than milk. The floor should be flagged, for the coolers to rest upon. All the dairy utensils should be perfectly sweet, by the use of scalding water after they have been used, and scrubbing, rinsing, and complete drying in the sun or wind. Slovenly women are unfit for the dairy work, as a woman who does not keep her own person clean and tidy will not be disposed to take much trouble to clean and polish milk-pans, churns, tubs, pails, towels, and hair-cloth sieves. Cows in general are milked but twice a day, morning and evening; but some of the Durham cows, particularly when in full season and abundantly fed, will require to be milked at noon also. In this case nothing is really gained in the quantity

of milk, and its quality is weakened, as twelve hours are required for the due chemical preparation of the milk. Therefore, the tendency to this want of retention in a cow is not to be encouraged; the milk should only be drawn off at supernumerary times, if the udder be excessively distended, and the milk flows spontaneously. At each regular time of milking the contents of the udder should be completely drawn off—the last drop is the richest: when there are two, three, or more cows, the dairy-maid, if she understands her business, will go with a separate vessel and milk the strippings into it, until each udder is perfectly dry. This small portion of rich milk will give her more cream than a larger quantity, and she reserves it, if she be a prudent person, for her own tea.

A cow should be handled with exceeding gentleness, otherwise milking may become an unpleasant or even a painful operation to her. If a cross-grained man, or woman, with a vinegar face, handles the teats roughly, and bullies a cow of sensitiveness, she may refuse to let her milk flow, though she would yield to the first touch of a good-tempered person. If the udder be hard, it will require fomentation with lukewarm water and gentle rubbing. It sometimes happens that the teats become sore; in this case an application of Florentine oil, after washing the affected part with soap and water, will probably cure it.

A cow may be milked until within a month of calving, provided the milk does not curdle on being slightly warmed, or possess a salt taste; either would be an indication that no more milk should be taken.

The milking should begin at six o'clock in the morning, and at the same hour in the evening, and the milk should be passed immediately through a hair sieve into a cooler.

Making Butter.—There are two general modes of doing this—by churning the cream only, or churning the milk and cream together. By the first mode the cream is left in the coolers until it is of fit consistency for churning; and this condition will depend on the temperature and

state of the weather: it may rise and thicken sufficiently in twelve hours, or it may require some days' resting on the milk; and it is best not to skim it off until ready for churning, for it will keep better on the milk than if collected with other cream: and it cannot be churned too soon after it has been floated off or skimmed. The cream, too, which first rises to the surface is thicker and better flavoured than that which rises afterwards, and is longer exposed to atmospheric influences. It is evident that in pursuing this method, there must be a double set of coolers for each day. The heat at which butter can be obtained ranges from 45 to 75 degrees Fahrenheit; but, butter of the best quality is obtained by churning the cream at 51 degrees, the agitation of the milk raising the temperature towards the close of the operation, to 55 degrees, and this will be in two hours if the milk has properly ripened.* It is said by the same accurate experimentalist, that cream churned at 56 degrees will yield the greatest quantity of butter, and that 53½ is the best medium for obtaining both results. If the cream be too cold, the butyraceous particles are too hard, and not sufficiently glutinous to combine; if, on the contrary, the cream be too warm, the particles of butter, from being too soft, separate afresh by the churning, and recombine with the milk.† It is easy to warm the cream sufficiently, but not so, to cool it.

Where milk and cream are churned together, the management is very simple. Each milking is left in a cooler during twelve hours, and then put into an open barrel, in which it remains from thirty to forty hours, according to the temperature of the air. The dairy-maid knows when it is in a fit state for the churn, by dipping the tip of her finger into it; if ripe, the cream adheres to it like paste. Each meal is churned separately, if there be a sufficient quantity; therefore, where many cows are kept, there must be by this mode two churnings every day. More butter is obtained by this method than the other, and the butter-milk is better.

* Pooler's Manual. † Von Thäer.

If much skim-milk be required, the former method is preferable.*

The Rearing of Calves.—In a state of nature, a calf remains with its mother, while the milk secretion flows into the udder; but the domesticated cow is in an artificial state, and her calf must be artificially reared.

I can imagine cases in which the unfavourable con-

* In a paper presented to the Society of Arts by Mr. Carter, a process is detailed for procuring the greatest possible quantity of cream:—"This produce of the dairies of Devonshire is known by the name of 'clotted' or 'clouted' cream. As there is no peculiarity in the milk from which this fluid is extracted, it has frequently been a matter of surprise that the process has not been adopted in other places of the kingdom. A four-sided vessel is formed of zinc plates, twelve inches long, eight inches wide, and six inches deep, with a false bottom at one half of the depth. The only communication with the lower compartment is by the lip, through which it may be filled or emptied. Having first placed at the bottom of the upper compartment a plate of perforated zinc, the area of which is equal to that of the false bottom, a gallon (or any given quantity) of milk is poured (immediately when drawn from the cow) into it, and must remain there at rest for twelve hours: an equal quantity of boiling water must then be poured into the lower compartment through the lip; it is then permitted to stand twelve hours more (*i. e.* twenty-four hours altogether), when the cream will be found perfect, and of such consistence that the whole may be lifted off with the finger and thumb. It is, however, more effectually removed, by gently raising the plate of perforated zinc from the bottom, by the ringed handles, by which means the whole of the cream is lifted up in a sheet, without remixing any part with the milk below. With this apparatus I have instituted a series of experiments, and as a mean of twelve successive ones, I obtained the following results: four gallons of milk, treated as above, produced in twenty-four hours four and a half pints of clotted cream, which, after churning only fifteen minutes, gave forty ounces of butter; four gallons of milk, treated in the common mode in earthenware pans, and standing forty-eight hours, produced four pints of cream, which, after churning nineteen minutes, gave thirty-six ounces of butter. The increase in the quantity of cream, therefore, is twelve and a half per cent., and of butter upwards of eleven per cent. The experimental farmer will instantly perceive the advantages accruing from its adoption, and probably his attention to the subject may produce greater results. I shall feel richly rewarded if, by exciting an interest on the subject, I can produce any the slightest improvement in the quality, and of producing an article which may properly be deemed one of the necessaries of life."

sequences affecting the cow may be trivial compared with the advantages arising from the perfect rearing of the calf of superior breed. In such cases, the natural course may be the preferable one. They are, however, but exceptive cases, and the result, as respects the pet calf, may be its death by suffocation, from the superincumbent body of its mother when lying down; and these unpleasant consequences regarding the parent:—as she cannot be regularly milked while the calf is with her, there may arise, from the reabsorption into her system of the residue of milk which the calf does not draw away, a contraction of the udder, that may ultimately disqualify her for the dairy: when the calf is reared, it may be very difficult to handle the cow's teats; she may have become intractable, and distressed beyond measure, by her yearnings after the weaned calf, refuse to hear the sweet strains of the milk-maid, however soothingly she may sing—

> "O Katy, O Katy, my pretty little cow, stand still;
> But if ever I milk you once again,
> 'Twill be sore against my will,"

and kick the pail to pieces.

One of the two ordinary methods of rearing a calf is to allow it to suck the cow and then feed it with skim-milk, or milk weakened with water, or liquid substitutes for milk, until it can subsist on grass. The other is to let the calf suck the three or four first meals (for medicinal as well as alimentary purposes), and then feed it regularly from the pail every morning and evening.

The advantages of the last, and I think best method are, that the quantity deemed sufficient for the calf—according to its size and age—can be exactly given, and the transitions from one dietary to another easily made, and that the systematic milkings of the cow, so as to render her milk most beneficial for all purposes, are not interrupted.

Supposing, then, the latter method to be adopted: during the first fortnight the milk should be given to the calf warm from the cow, and cold milk should not be

offered to it for a fortnight or three weeks afterwards: a little warm water may be added in case that the new milk should, from any neglect or accident, become cold. Thenceforward, cold milk will not be objectionable. Every dairy-maid knows how to make a calf drink, by first dipping a finger into the milk and putting it into the calf's mouth, while she at the same time plunges this into the milk; a wisp of hay equally satisfies the calf; and even this is hardly necessary, as it may soon learn to drink without sucking.

Mr. Cramp, of Lewes, several years ago received a medal from the Board of Agriculture for his economical mode of rearing calves, without any view to their high condition.

His system was, after the first two days to milk the cow and feed the calf twice a day from the pail, which there was some little trouble in teaching it to do. At the end of *three* weeks he gave skim-milk, adding to it three hot pints of oatmeal gruel, at each meal, and gradually cooling down the drink, milk-warm at first, until it became cold. He continued this course of feeding until the calf was about ten weeks old, and then by degrees diminished the quantity of oatmeal, and diluted the milk with water; when the calf was fourteen weeks old, and the gruel and milk were omitted altogether, it was able to eat bran and grains, which it was allowed for a month longer. By this treatment the butter of the milk was saved after the first three weeks. It is, however, very false economy to realize milk and butter at the cost of the condition of a calf, if of a valuable breed more particularly. Full justice should, as a general rule, be shown in the nursing period to the domesticated animals of all sorts, and the mother's milk is the best nutriment. A great point is gained by rearing a calf in the winter; it gets a good start in its growth, by being able to commence its feeding on young grass, clover, lucern, vetches, early in the year, and to consume roots, &c., when the calves reared in the spring and early part of the summer are unable to do so.

Calves may be vealed for the butcher at any season: they should have the best milk, and plenty of it too. In this case, indeed, the calf may be allowed to take the entire milk of its mother as soon as it can do so; and as it is intended (it ought to be allowed) that the calf should have the entire of the mother's milk as soon as it is able to exhaust it, the objection to letting the cow draw the liquor for itself is much weaker than in the case of calves that are to be reared. They are taken off when fat, and killed at once. There is no weaning period on the part of the calf; this, at least, saves one of the parties from unhappiness. A strong calf will be perfectly able to extract from the udder every drop it contains; in fact, the mother's milk is often insufficient for a great calf well advanced; and therefore no danger will arise to the udder, as pointed out in a previous case. No substitute for milk will render veal so delicately white and well-flavoured. Chalk should be left always within reach of the calf, which sucks it by useful instinct, and this condiment serves to neutralize acids in the stomach, as magnesia does in that of a sucking infant. Oil-cake, linseed, eggs, and even damaged white bread with some milk are often given on the continent to veal-fed calves.

SWINE.

You will find it expedient to keep a brood sow; some of the roots which the field and garden will produce cannot be more beneficially used than in contributing to rear some pigs: vetches, lucern, cabbages, cattle-beet, and parsnips more particularly, with buttermilk and some bran, will support pigs when once reared, until the time for putting them up to fatten.

The Berkshire breed is not excelled in good qualities; yet the Hampshire, which closely resembles it, and the Cumberland and Tamworth, have admirable points also, and from their precocity of growth and early aptitude for fattening are deservedly favourites where they are known.

A sow ought to have two litters every year, and matters should be so arranged that she may farrow in March and September, to have the young ones weaned in mild weather. If, however, roasted pig be one of your favourite dishes, and you have appetite for consuming all the sucklings, the accouchements of the sow need not be limited to those seasons.

The number at each farrowing varies much, but the first litter is generally a small one; the diminutive varieties, the Chinese for instance, produce the largest litters.

During the first days after farrowing the sow ought to get milk-warm food, but rather sparingly, lest feverishness should arise. The young ones, when three weeks old, will eat corn and steamed potatoes, &c. They should be weaned at the age of eight weeks, and then their food should be toppings or pollard, with some sort of milk, if easily procurable, meal porridge, the rinsings of the dairy vessels, and steamed vegetables. They will soon afterwards begin to eat vetches and clover with avidity, but that is but a niggard economy which would limit them to such washy food, even with whey and buttermilk in addition.

Though close confinement is unfavourable to the growth of young pigs, the most approved sorts will thrive in a pigsty yard of very moderate dimensions, if kept perfectly dry and sweet. The great size and disgusting degree of fatness to which some of the prize brutes have been brought at three and four months old, kept in close quarters without exercise, proves that this may be dispensed with. A neat amateur farmer cannot have such an unruly stock running about his lawn or paddock, or near his house at all, therefore he must generally keep them confined, unless, indeed, he has a wood or plantation at his command, with a Gurth for the special service of pig-keeping. It is best, then, not to give the pig the sensations of liberty at all, else they will not contentedly stay in their little yards; they should be inured to them from the beginning, but making an exception, as far as

circumstances will permit, in the case of the brood sow, which will require liberty for promenading in the paddock, or in a stubble or fallow field occasionally.

Porkers are in the best order for the table at four months old, and if they have been fed a good deal on milk the meat will be delicious. After six months old they are no longer desirable as porkers, and should be considered as maturing their growth, until they are put up to be fattened for bacon, which, for the use of a gentleman's family, may be (taking the Berkshire breed as the standard) at from ten to twelve months. After six weeks of feeding on toppings and bean meal, and finally on barley and pea meal for four weeks more, they will be in the best condition; you do not want to have them wastefully fat.

The sties and yard should be always clean and dry, and the trough frequently washed. And to prevent food from remaining in it unconsumed, and therefore tending to sourness, a little hanging door, swinging on hinges, should be suspended over the trough, and placed in some opening of the wall, dividing the yard of the fattening pig from that in which the store pigs are kept. When the former has eaten to repletion, the hanging board can be drawn to the inside, and fastened there by a fork or button, while the hungry and less fastidious pigs on the outside poke their snouts into the trough and lick up the food which the tenants of the inner sty had left.

MANURES.

Some knowledge of the principles of agricultural chemistry is as useful as it is interesting to the mind of an educated man, who imparts the dignity of science to what he otherwise would cultivate as a mere practical matter. Yet theory is sometimes carried to the verge of the ridiculous. When Lord Kames said to his bailiff, "This is the proudest day of my life, for I have discovered a

manure so powerful that the full of one of my waistcoat pockets will serve for an acre," we smile at his lordship's enthusiasm, and are not surprised at the bailiff's reply: "Ay, ay, then, by my troth, my lord, it will not be long till your lordship puts the crop in the other;" nor can we preserve a very grave or British Association-becoming countenance, when we read of some of the results of science, proving how theory may be carried to excessive and absurd lengths; as in the instance of a really scientific French chemist, who noted a decided difference between the dung of cocks and hens, and even a distinction between that of hens which lay and those which do not lay eggs.

Yet while we perceive that an inquiring mind may carry its pursuit to an extreme, it is not to be concluded that there is no use in such experiments and deductions; if they be correct, they may be very important as stepping-stones to very useful discoveries.

There are, even in the comparatively advanced state of agricultural chemistry, many things yet undecided regarding the nourishment and growth of vegetables, and the precise influences of manures.

It is known that certain soils and manures supply copious nourishment to plants, and that some of these are fed from substances which would be innutritious to others; and chemistry has made many discoveries as to the sources from which aliment is conveyed, and the mode by which particular influences act upon vegetable life; but there still remains much to be learned.

We know that certain classes of plants contain within themselves, either individually or in common with some others, various substances—mucilage, starch, gluten, albumen, &c., &c., with vegetable acids and alkalies.

There are various mineral substances also in the composition of plants, such as potass, lime, soda, sulphur, combined with acids of various kinds; not that all these substances are combined in each plant, but some of them are found in different plants according to their kind, and in different proportions. All the constituent parts of

plants are acquired principally through the food which they obtain in the soil, the atmosphere and the manures which supply them with carbon, hydrogen, oxygen, and nitrogen—the four gaseous fluids which are component principles of all plants.

Carbonic acid is a gas emitted during the decomposition of various substances, and is one of the chief supporters of animal life. According to Liebig, the atmosphere is the principal source from which plants derive nourishment. The ammonia which results from the decomposition of animal substances is, whether it exists in the atmosphere or in the soil, the great source of the nitrogen which is found in plants, especially in their seeds.*

* I had the privilege some years ago of reading a MS. essay, by M. Clausse, on the food of plants, from which the following remarks have been epitomized. The paper was read by its author at a meeting of the Archæological Society, at Avranches, in Normandy, of which I am an honorary member. The process of germination was there clearly described by him, and as it is so intimately blended with the subject of manures, it shall have place here.

Seeds enclose in an envelope, easily permeable by moisture, but less so by air, all the elements necessary to the nourishment of the germ, viz., carbon, hydrogen, oxygen, azote (nitrogen), and, when laid in the earth, they absorb moisture from it, ferment from heat, rot, and yield to the embryo plant all that it requires through the period of its germination, during which it requires no external nourishment. That heat and moisture are then sufficient, is evident from the consideration that seeds will germinate without any earth whatever. When the embryo has absorbed all the internal moisture the radicles are formed, and they soon begin to extend their fibres into the soil; the plumule directs itself towards the surface, and then the plant begins to derive its nourishment from external sources.

The mode in which the nourishment is conveyed is as follows. Water, which has the power of dissolving its own volume of carbonic acid, carries along with it a portion of this into the earth as it descends, and the heat and oxygen of the atmosphere, combining their powers, by degrees convert into carbonic acid gas all the fertilizing principles which the soil contains, and convey it to the plants through their roots, which are the sole conductors of nutriment to them, until the stem rises to the surface and developes its leaves, which perform their parts by absorbing air and moisture. If the humus contained in the soil, or the earth itself, gave the sole

Farm-yard dung is the grand treasure of the farmer, as it supplies the soil with the chief elements of its fertility. "If we only consider the subject of manures, we shall perceive one of the most striking bounties and benefits of the divine ordination and wisdom, with which we are blessed in a thousand ways without knowing it. This very substance, the refuse of everything, had it been useless, must have accumulated in heaps, intolerably noisome, and perpetually pestilential; but, by the blessing of Providence, it is every man's interest to remove these otherwise increasing mountains of filth, and by decomposition in various ways, concealed in a great measure from us, it gives increase to our fields, and adds to the means of industry and the rewards of the husbandman." *

Farm-yard dung is the principal of the animal and vegetable putrescent manures, being chiefly composed of the excrementitious discharges of cattle, and straw and other decomposed vegetable substances; and this is more or less fertilizing, according to the qualities of the food of the cattle, and their condition. Those fed on potatoes, turnips, cabbages, &c., and succulent grasses, and above all on oil cake, yield dung of far richer quality than that which is obtained from animals fed upon straw or innutritious hay. In the dunghill, too, there is generally

nourishment to seeds, it would signify little whether they were placed deep in it or within the surface. But we know that according to their respective nature, size, and strength, should be the depth at which they are sown; if sunk too deep they perish, after consuming all the nutriment contained within themselves, because, not being in contact with the atmospheric air, the humus which surrounds them is without oxygen, heat, and moisture, for its decomposition and conversion into carbonic acid. They die, in fact, because the exterior nourishment fails.

When the leaves are developed they become the principal agents of absorption, when the parched earth forms a crust upon the surface, impenetrable to the air. Those plants which have no leaves perish from want of conductors of air and moisture, while those which have them continue to live, if they be moistened with dew or rain, and according to the extension of their foliage will be the vigour and vitality of the plants.

* Part of a speech of the late Lord Erskine at an agricultural dinner at Holkham.

much purely animal matter—blood, the bodies of dead animals, and other substances, tending to render this mixed heap highly putrescent and rich in its ingredients, of which the ammonia contained in urine is a principal substance, although in no point of our husbandry is there such wasteful extravagance. The economy which the Belgians and Swiss observe in providing cisterns and tanks for the collection of the ammoniacal liquids which are discharged in the stables and cattle-sheds, &c., is well worthy of our imitation. No farm is complete without such reservoirs, and it is absurd to expend money on guano and other manures abounding in ammonia, when it may be saved to a sufficient extent in our own farm-yards, with a very trifling expenditure. The effect of sprinkling grass fields and clover leys with the ammoniacal liquid, in a putrescent state, is marvellous.

Stable litter should be mixed with that from the cow-house and pig-sty, as it ferments excessively, and burns up, to the loss of its ammoniacal salts, and of the fibre of the straw: it should be carted away, then, to any field for which it may be intended, and mixed with the cooler litter and dung of the cow-house and pig-sties; and with these fermenting substances the scrapings of roads, scourings of ditches, and mould from head-lands, should be intermixed, in order that they may be decomposed, by close contact with the heating and putrescent materials, and absorb matter which otherwise might go to waste. Composts of this sort are excellent for turnip crops, and for top-dressing fields. The courses of mould, grassy turf, &c., intervening between those of fermenting litter, should not be more than about three inches in thickness, else the fermentation of the latter ingredient will not fully act upon their cold nature: on turning the compost a thick layer of earth would be found undissolved and rough, requiring much labour in pulverizing: if courses of unfermented substances were so interposed between the others, two or three turnings would be necessary to reduce the whole mass sufficiently; and as each disturbance of a compost containing such ingredients is

accompanied by a waste of its gases, the less it is opened out the better—more than a moderate degree of fermentation being wasteful. The loss of putrescent manure in weight and active energy, by excessive heating, is also very great. If the litter from the different animals of the farm-yard be accumulated together on any spot of a field where the manure is to be used, but left for some weeks, this heap should be covered with a coat of earth, beaten into a crust with a spade, to prevent the exhalation of its gaseous elements. But it is economical, no doubt, to plough fermenting manure fresh into the ground, as a preparation for turnips, as is always done by English farmers in the preparation of land for wheat, and generally for beans: yet, with regard to turnips, it is so important to have the seed in close contact with the manure, in order to accelerate its early growth, for reasons that have already appeared, that I prefer the employment of manure for them when the drills which they are to occupy are being formed. Some farmers, however, after ploughing in fermenting manure evenly through the land, a few weeks before the time of turnip-sowing, give the earth a fresh turning when the seed is about to be sown, in order to produce that activity of action which will influence the germinating seed; and this certainly meets a principal objection to the application of manure in this manner. It is obvious, however, that if the dung be not *short*, and well blended with the soil, the drill-machine cannot act —its progress would be continually interrupted by long, undivided litter. It appears to me farther, that much waste of alimentary matter is occasioned by the ploughing of putrescent manure into the soil for broadcast-sown turnips; much of it is exposed to the surface in spite of the ploughman's anxiety to cover it as the plough moves; the evaporating influences of a fiery sun or a strong wind must deprive it of many of its essential properties; whereas from such manure, buried in a drill, comparatively fewer exhalations occur.

Guano.—Nothing is more astonishing in the commercial statistics of this country, than the enormous con-

sumption in it of this admirable manure, principally brought from Peru and other parts of the South American coast, and employing hundreds of ships and thousands of sailors in the importation of it. Nor is our surprise lessened by the consideration that the sewerage of our cities and towns, running waste, carries with it the very substances contained in this foreign and costly manure, though not in the same concentrated form, yet sufficiently rich in its composition to render it an object of national anxiety that the sewerage companies, which are endeavouring to render the impurities to which I am referring reproductive to our soil, should succeed in consolidating, for the farmer's purposes, the liquid or semifluid manures which are now discharged into the seas around us.

The Peruvians have known the value of their guano, from the earliest records of them; but until Humboldt and Bassingault brought it to the notice of the European agricultural world, it was not an object of commerce, though in accumulations of enormous depth and extent, containing thousands of millions of tons, and undergoing in their dry climate no deterioration of quality. It is composed of the *débris* of cormorants, sea-gulls, and other marine birds, collected during the progress of ages, and apparently defying exhaustion. This will be apparent, when we are assured that in one island this animal substance covers three miles in circumference, and is in some spots two hundred feet in depth.

It is beyond all comparison a highly efficacious manure, because most rich in the chief elements of vegetable life. Knaves have been tempted to adulterate an article which sells for £12 a ton, and precautions are necessary to guard against the villany of unprincipled men, by purchasing only from merchants of undoubted honesty, and, when practicable, directly from the ships freighted with the guano. Doctor Thompson, an agricultural chemist, has given the satisfactory assurance, that out of many samples of guano submitted to him by purchasers for analysis, he scarcely ever found instances of adulteration at the hands of the importers. It is, therefore,

through pretended importers, retailers, and subordinate agents, that the sophistication takes place. Criteria are given by which the genuine guano is distinguished from the spurious. The colour ought to be light brown, with a strong smell of ammonia; and when calcined, the substance should leave as the residuum, a white ash of bone earth, which, heated with diluted muriatic acid, will not effervesce: —this proves that no carbonate of lime is present; and it should dissolve, leaving only two per cent. of white sand and very minute shells. A spurious mixture was found by the same chemist to contain more than ten per cent. of carbonate of lime, and twenty-six per cent. of water. But this was an honest specimen, comparatively with another, analysed by Dr. Hodges, of Belfast. He detected forty-seven per cent. of carbonate of lime, and twenty-two per cent. of water, in a manufactured article offered for sale as guano.

If the rotations do not enable you to collect on your own farm an ample supply of putrescent manures, the purchase of some guano will always enable you to supply any deficiency in the other; and I believe that when pure it is the best of all extraneous manure.

A surprising testimony to its value is offered by Mr. Stevenson's report on the farming of East Lothian, viz., upwards of 400 tons of guano were applied to one parish, containing 6,386 acres, last year, and 500 tons have been ordered there this year. The average produce of the wheat has increased about seven bushels per acre, and that of barley and oats something more. From 12*s.* to 18*s.* per acre has been annually expended, on the average of the whole cultivated land of that county, on the artificial portable manures.* When I visited some of the great farms of that celebrated county, nearly thirty years ago, I thought the agriculture perfect, yet the report to which I have just referred states, that the produce of animal and vegetable food for general consumption has

* An approved imitation of this manure may be bought by application to the agent, Mr. Spencer Smith, 20, Liverpool Terrace, Liverpool Road, Islington.

been *doubled* within this period. Some of the farmers there expend £1,000 a year on guano.

In the application of guano to turnips, it should not come in contact with the seed, but be scattered very near it, in dry ashes or earth, as a safe and cooling medium. The late Mr. Caird made a trial, which is satisfactory as to the utility of guano. When sowing a very large field of wheat, he laid on two cwts. of guano per acre, on the entire field, excepting one acre in the centre. The produce of this and of an adjoining acre were kept separate from each other, and from the rest of the field. The results were—on the acre with guano, 44 bushels of grain, and 40 cwts. of straw; on the acre without guano, 35 bushels of grain, and 30 cwts. of straw. The guano cost him £1, for which he had 9 bushels of wheat and 10 cwts. of straw.

In this case, when we calculate the weight in pounds of the crop of wheat, or reflect that 424 lbs. of guano may thus suffice to the nourishment of such a heavy crop, it is evident, while allowing for supplies of carbon, nitrogen, oxygen, hydrogen, and ammonia, in inconsiderable proportions, from the atmosphere, that the land must have been stimulated to afford unusually great portions of the alimentary principles contained within itself, in which case its exhaustion more or less would be the result.* And as it would in such case require more than an ordinary quantity of putrescent and renovating manures from the farm-yard, and more gentle treatment afterwards, these circumstances would materially counterbalance the seeming advantage derived, as in the case of Mr. Caird, from the use of a small portion of guano, if unaccompanied with bulky and more durable manure, leaving some residuum in the ground. And that repetitions of stimulating doses of guano, without the more solid manure, would, if they produced a second or

* Under the Rev. S. Smith's method of wheat culture (which will be explained in subsequent pages) the inorganic elements, however, would be abundantly supplied; and with his practice, guano would *be an in*valuable and safe agent.

third good crop, task the energies of the soil to such a degree, as might induce sterility for some time afterwards, is at least probable. Guano may be considered a valuable auxiliary stimulant, but not as a substitute for the dunghill.

Noir Animal is principally composed of bones burnt to powder in close vessels. The French use it in the process of sugar-refining; afterwards, being saturated with the refuse of the sugar, it serves as a powerful manure.*

A manufacture of animal substances, from the carcase of a dray-horse to that of a mouse, including, between these extremes, cats, dogs, pigs, and all sorts of carrion that may fall into the Thames, or be exposed anywhere and purchaseable, is in operation at this time, by an industrious experimentalist in London, who has succeeded by dissolving the bones with the flesh, in reducing both to a sort of *noir animal;* and from its constituency it ought to be a prime fertilizer.†

Bone-dust is one of the best of the putrescent manures for turnips, on dry soils: it contains fifty per cent. of phosphate, and carbonate of lime, and to the chemical properties of these two substances the good effects of bone-dust on the vegetation of plants are attributable. On light lawns and peat soils, thoroughly drained, bone-dust applied to turnips produces great crops: and it is not transient in its nature,—consumed by the crop which it feeds, and leaving the soil which it has stimulated in an exhausted state; the succeeding crops of corn or grass are benefited by bone-dust, whether applied in compost to the turnips (which is probably the best mode), or drilled by itself with the seed. Crushed bones cannot run through the hopper, and therefore must be lightly harrowed in, before the sowing of the turnip seed. It is important that this and other applications of a similar nature should almost be in contact with the turnip-seed,

* The French rogues adulterate this with black peat, ground in mills for the purpose.

† I believe that Mr. Smith, of No. 20, Liverpool Terrace, Islington, is agent also for this manure.

which has a remarkable appetite for stimulating manure in its early growth; and the application of this substance near the surface does not in any degree occasion its waste from exposure to the air; no part of it is eventually lost to the ground; wherever it becomes reduced and incorporated with the soil, it fertilizes it; and its effects are said to be perceptible on grass-land for many years,—no doubt, because it slowly dissolves. Composts of earth and bone-manure are excellent (at the rate of fifty bushels of this to five cart-loads of earth, to the acre). It is a good practice to mix bone-manure with dung, as the fermentation produced in it by the latter tends to make it more immediately active. In a combination of this nature, a lesser quantity of dung and bones will suffice, than if the ground were manured by either separately.

Bone-dust has a high reputation as one of the cheapest and most lasting fertilizers of clover and grasses generally, on heavy loams. It is recommended to distribute the dust at the rate of two tons to the acre, over the young grasses, in September or October, when a shower of rain may be expected. Crushed bones may be mixed, with perhaps more economical results, with the scourings of ditches, road scrapings, or any earthy matter, in the previous autumn; a fermentation takes place in the compost which tends to render it a fertilizing mass, when put out in the following spring. An instance of the powerful effect of such manure on grass land is stated in the *Agricultural Gazette*. It appears there, from the report of Mr. Booth, a very distinguished cultivator, that the productiveness of his land in grass was increased in the ratio of five to three (besides allowing one-fourth to be mown), by bone-compost, at the rate of three quarters of a ton of bones to the acre. His after management consisted in going over the manured ground with a sharp harrow, and sowing a mixture of about six pounds of white clover and three pounds of trefoil to the acre, covering with a roller, and finishing with a bush harrow.

Superphosphate of Lime.—The bones of animals constitute the principal source of this. This manufactured

substance is prepared by dissolving bones with sulphuric acid, but in this manufacture fraud is committed, as in the instance of guano. Some so-called superphosphate of lime was sold by the agent of a manure company at £7 5s. per ton, though it was only worth the value of the bones contained in it—about £2 per ton. A pure superphosphate of lime should contain 12 or 15 per cent. of soluble phosphate; but Mr. Way found in the specimen which he analyzed, less than 1 per cent. of it. It proved to be a mechanical mixture of bones and gypsum.

Dr. Anderson, professor of chemistry to the Highland Agricultural Society of Scotland, ascertained that a *commercial* superphosphate of lime, submitted to him for analysis, did not contain any superphosphate whatever. A very curious case is related by a gentleman who was a victim to some of the frauds committed by the compounders of certain substances sold as superphosphates, guano, &c. He purchased three hundred pounds of ten chemical ingredients, including fifty-six pounds of what was called by the vendors, superphosphate of lime, and tried his hand at combining the ingredients, which contained every supposed element contained in plants. This mixture, when tested by Doctor Anderson, proved that "adulteration of the simple ingredients must have existed to an enormous extent, reducing the value of the compound considerably." The gentleman anticipated chemical changes in the ingredients, from their combinations; but this alone did not account for the results,—frauds had been practised with them. The same individual offers this judicious remark respecting all the artificial manures, even when genuine: "Let them be prepared with ever so great a degree of accuracy, it cannot be expected that they will act similarly on all occasions. Soil, climate, and locality must of course exercise influences productive of very different results, and hence, in a great measure, arise the discrepancies that we so frequently hear of, being experienced in them."

Whatever be the artificial manures, the mode of

using them, as suggested by this practical and scientific writer, is judicious, viz., to mix the fertilizer, if it be caustic in its nature, with two or three times its bulk of ashes, road scrapings, or earth, and to distribute it, on stony soils, in drills with the seed; on light porous soils, to scatter it as a top-dressing over the plants when just above ground. Four hundred pounds of the superphosphate will manure an acre, and it is better to apply it in small portions, two or three times, than all at once.*

Nitrate of Soda.—This is raised from quarries on the Peruvian coast, and by analysis is found to contain, if pure, ninety-four per cent. and a fraction, of this substance itself; the remainder consists of minute portions of potash, magnesia, lime, chloride of sodium, sulphate of potash, and water. It is often adulterated, and, as a manure, bears no competition with guano, though it has been used and recommended by many persons. Its demand for agricultural purposes has received a great check, and probably will be confined to the manufacturers, who require this substance much more than the growers of plants. It has, however, produced on dry gravelly soils an improvement on the herbage, and in some instances increased corn crops, to which it was applied as a top-dressing in spring. The first visible effect of it is to produce a deeper green in the colour of vegetables, which is the chemical result of the alkali on their juices. A bright green leaf is generally a sign of a vigorous vegetation, but here this has been deceptive, and the greener stem has not produced the fullest ear.

MINERAL MANURES.

Lime may be termed a manure; in a state of dissolution it is a suitable food to many plants: some orders of them are distinguished as lime plants, because it actually enters into their composition, as in the instance of wheat, in a great degree; and the consequence is, that no soil will

* Agricultural Gazette, January 31, 1852.

produce wheat well in which lime does not exist, either naturally, or through the medium of the manuring elements supplied to it; but as a very small portion of lime would suffice for this purpose in any soil, and as farm-yard manure contains enough of it for the mere food of the lime plants, the efficacy of lime on vegetation must rather be sought for in some other source or agency. It may have the power of arresting the escape of ammonia, as this enters the porous soil after a falling shower, and also *fixing* there other elements of fertility, by whatever agency introduced into it. It acts also as an alterative or corrector of the soil, by neutralizing and dissolving inert vegetable matter, and reducing it to a state in which it will yield nutriment to plants, thus acting *intermediately* as a manure; it tends also mechanically, to loosen cohesive soils, improve their texture, and render them fertile; and thus it is an indirect manure, in cases in which it may not be positively a source of nourishment to plants. It is one of the most lasting, as it is one of the most powerful of the mineral manures.

Yet the philosophy of its agency was not known until a century ago, when Professor Black ascertained that limestone and all its modifications, marble-chalks, and marls, consist of a peculiar earth, united to an aërial acid; that the acid is given out in burning, occasioning a loss of more than forty per cent., and that the lime in consequence becomes caustic.

Farmers understand by lime, burnt lime-stone, chalk, or shells. Lime enters largely into animal and vegetable substances; it enters into the composition of many bones, the eggs of birds, and all good soils: it is found in the straw of wheat especially, in other cereals, and in some leguminous plants. In a table of sixteen soils, minutely analyzed by Von Thaër, I find seven having little or no carbonate of lime, and of these, two are entered as poor sand, fit only for oats or buck-wheat, and three others unfit for wheat (chiefly from the same deficiency), though capable of bearing barley. Yet it would appear from the comparative ingredients of those soils, without

entering into the details of the several proportions of clay and sand (important as they are, however, in the analysis), that three or four parts of carbonate of lime in a hundred, of the ingredients of a soil, are sufficient to constitute one of first-rate quality, provided that from four to ten parts per cent. of *humus* are also contained in it.

Of what this great element of nutrition to plants consists ought to be well known. Humus is a rich black mould, the product of the slow decomposition, principally, of vegetable matter. Grave-yards, grass-fields long in pasture, and very highly manured old garden soil, contain large proportions of it. It is consumed by plants, and reproduced by them in their decay; and the restoration of it, in sufficient quantities, to land from which it has been extracted by exhausting cultivation, is one of the farmer's principal objects. It is necessary to bear in mind the character of humus, in order to see under what conditions lime may be introduced into land containing it in a large degree; because ignorance in this respect may be attended with very injurious results, lime being very potent, whether for good or evil, and requiring skilful management accordingly.

Lime may be applied to land either in the caustic or in the carbonate state. When taken fresh from the kiln to a field and slacked there with water, or allowed to slack quickly by exposure to the air, it has, in its state of powder, a tendency to burn vegetable substances, decompose and dissolve them, and to render them alimentary to new vegetation. And where there is an excess of coarse and bad plants, which it is desirable to dissolve, it should be shovelled over the surface in a dry and powdery state. Its chief efficacy in producing the desired effect would be lost by allowing it to part with its caustic quality, which it loses immediately after it lapses into the carbonate state, which is one of perfect mildness, succeeding the hydrate state when full time has passed for the expulsion of water, and the absorption of carbonic gas. If you want to get rid of a bad class of grasses and weeds without breaking up the field, then, if you apply

lime, it ought to be used in the form of quick-lime, and liberally spread. White clover is generally one of the new order of grasses which make their appearance in such case, as lime is an earth congenial to it. But be it remarked here, that it is extravagant mismanagement to put lime on such bad herbage as we are supposing to exist, until the land be drained, if superabundant undermoisture be the cause of the defective vegetation, as the dose of lime in such case will only give temporary and limited relief to the diseased land. After draining, the good effects of the lime will be more apparent in the second and third year afterwards than in the first. But quick-lime, which will act on inert vegetable matter in the soil, will also affect any putrescent manures in the ground, and this must not be permitted. Supposing quick-lime to be applied to a half-fallow (the most economical and effective way), the succeeding crop of turnips, &c., should not be sown until the quick-lime has lost its caustic powers, else it would neutralize much of the good effects of the dung which such green crops will require; and generally it is better not to apply lime and dung to land in the same season at all. Quick-lime should never be applied with dung, nor mixed with it: it would be ruinous in a *dunghill*, but it is excellent, mixed with turf and any tough vegetable matter, such as the scourings of ditches and old sod-banks, which are to be reduced to a state of mould, for it dissolves all the fibrous matter it encounters, and then renders what had been inert a source of fertility.

The second form in which lime is applied, and that to which it is very soon changed, is the carbonate state (which it assumes from the absorption of carbonic acid), in which it has no burning power, and may be used in any quantities with good effect.

As lime, from its specific gravity, has a tendency to sink into the soil, it should be spread on the surface and lightly harrowed in, after the ground has been rendered loose by fallow ploughing.

Quick-lime, spread over a clover ley, is a capital

preparative for wheat. For beans it is not suitable; but as the potato is a lime plant (and it also classes with those to which potash is congenial, and of which it consumes a large proportion for its nourishment and organization), the previous application of hot lime to fresh land, not naturally calcareous, is the best mode of of preparing it for this important vegetable. The most abundant crops of potatoes are raised on land into which lime had been thoroughly introduced, with a moderate portion of farm-yard dung in the drills.

Sea sand contains carbonate of lime, and in some localities a very large proportion of it. Such sand produces marvellous fertility in parts of the south of Ireland.

Shell marl is a powerful carbonate of lime, and fortunate is the farmer who is within easy reach of it. It is incomparably the most effective of the marl class of mineral manures, being composed of the shells of fresh or salt water fish, partially decomposed, with the animal matter of their once living tenants, and innumerable aquatic creatures, transmitted in the progress of time into rich mould. Shell marl is found where stagnant water had long rested. When first raised it is of very unctuous quality, afterwards it becomes a gritty powder. Ten one-horse cart-loads of it are an ample allowance for an acre. On fallows it may be used with great effect for wheat, and is the only sort of marl that should be laid on broken land.

Clay marl, unless it contains a considerable portion of carbonate of lime, is hardly worth the expense of raising and carting to land not very near the marl-pit; for consolidating sandy soils it is, however, very powerful, both as a mechanical and as a manuring agent; but on such soils, to be fully effective, it must be laid in large quantities. Its effects are perceptible for many years, and to loose land, deficient in calcareous earth, it is of course highly beneficial.

Lime-stone gravel is one of the most abundant carbonates in Ireland. It is found in parts of Scotland also,

but I believe is unknown in England. On peat soil it is especially efficacious.

Chalk.—This calcareous substance, which constitutes so large an area of soil in Kent, Hampshire, and other eastern and southern districts, is not, according to Sir John Sinclair's authority, so powerful, when calcined, as burnt lime-stone. It has, however, all the properties of lime. When spread on the surface like clay marl, it dissolves, and acts in a similar manner. Chalk soils are pre-eminently good for wheat, sainfoin, and lucern.

Gypsum, or plaster of Paris, so called from being found in quarries near Paris, is a sulphate of lime, and found in the ashes of clover, rye grass, lucern, and sainfoin, in sensible quantities. It is therefore a congenial earth for them, but not worth the trouble of applying it where any carbonates of lime can be obtained. It produces little or no apparent effect on land, but it is conjectured that its utility to the grasses just named, if thickly sprinkled over them, is attributable to some inherent power of fixing ammonia derived from the atmosphere. If this be so, the liquid manures of the stables, and fermenting dung, cannot be more efficaciously spread on a clover ley, or any grass field, than after it has had a dressing of gypsum. On cereal or leguminous plants it does not appear to act; and as it exists in the manures obtained from grass-fed animals, the natural wants of grasses for it are sufficiently afforded to them through the dunghill, or directly from the grazing animals. Gypsum, like lime, is inert on soil deficient in vegetable matter. If used as top-dressing to grasses, the season for doing so is about the end of April. The allowance is about six bushels to the acre, and the best manner of spreading it evenly, is through a sieve, and when the leaves of the grasses are so moist that it will adhere to them.

MIXED MANURES.

Ashes.—Ashes are of this class, according to Professor Low, being derived partly from organic and partly from mineral substances. Ashes of coal, or wood, rank evidently among mixed manures; the former, though properly mineral, are generally mixed more or less with vegetable and animal matter in the ash-pit. They produce good crops of turnips, with a little fertilizing accompaniment on fresh land in good condition. Coal ashes are the most worthless of all substances as a manure; but as they may be rendered the means of raising a crop, which leads directly to the production of manure, they are not quite useless; the finer they are the better. They are, however, at best but a temporary support to the land, leaving no *pabulum* in it. But peat ashes are very useful, and excellent for turnips and top-dressing grass land.

The Newbury peat ashes, once so celebrated as a manure, in Berkshire, resemble those of Holland, as both contain a great portion of lime. In Berkshire this has been occasioned by floods washing down chalk from neighbouring hills to the vale in which this peat is found. Yet the modern artificial manures have almost superseded the use of this, though it may be purchased for 3d. per bushel. If ashes of this nature be little valued, the time has entirely passed for using burnt clay for any crop. The modern fertilizers are so portable, and if pure, so alimentary to crops, that it would be absurd to incur the expense of reducing mere clay to ashes, unless for their mechanical effects on cohesive lands, which are, however, more easily opened by underdraining, and the subsequent operations of the plough and harrow.

OUTLINES OF MONTHLY OPERATIONS.

JANUARY.

The earth is scarcely yet beginning to show symptoms of awakening energies. If fallow-land be fast bound by frost, its pulverization will be better effected by this natural agent, than by any mechanical agency afforded by the power and ingenuity of man. On clay, frost acts with peculiarly good effect. Dung or compost should now be carted out, if the ground be frozen, for beans or pease. This month may be favourable also for putting out chalk or marl. By leaving the loads unspread until crumbled by frost, they will be easily and evenly spread.

Composts should be collected, and those in an advanced state turned over and thoroughly blended. The farmer who trusts to the manures accumulated from his own farm resources, will have the satisfaction of knowing that he is not deceived as to their components, nor paying, under any of the specious titles of artificial manures, for powdered plaster of Paris, pipe-clay, sand, and water, with which some true elements of manure are indeed blended, but in very diminutive proportions. The following cheap compost has been known to produce good effects:—Let a platform of sods, road-scrapings, scourings of ditches, or good mould be formed, about six inches thick, twelve feet wide, and of any length. At one end lay a load of hot lime, and spread it out about four inches in depth. Let this be saturated with a solution of rock salt, or common salt, in the proportion of three pounds of salt to a bushel of lime. Pour the pickle gradually and evenly on the lime according as this imbibes it. Spread the lime, when thus wetted, two or three inches thick on the platform marked out, and cover it with four or five inches of earth. Treat the second load of lime after the same manner, laid in continuation of the first,* and so on,

* A compound saline manure termed economic, but costing £12 a ton! was found on analysis to contain thirty-six and a half per

until a sufficient length of area is formed. When the entire is thus covered, begin with a second series of loads of lime over the first course; treat them in the same way, until this be also finished, and proceed with a third and a fourth course. If the surface earth of a headland be used, it will be more convenient to have but one or two courses, and a compost of greater extent. When the whole is covered with earth, let the heap be cut down and well mixed, in which state it may lie until a short time before it is used, when it should be turned. Sea-water serves equally well. The muriate of salt when applied as above to the lime, has a chemical agency, which is found very beneficial. For top-dressing a grass-field, or for any of the usual crops, this simple and very cheap manure is valuable, at least, in aid of farm-yard dung. The feeding of all the stock with steamed roots, chaff-cutting, thrashing, winnowing, plashing hedges, eradicating briers and brambles wherever they may appear, keeping water-courses, ditches, and drains free, and under-draining, if there be any to execute, will give employment to labourers. Calves of the preceding season should be abundantly fed with Swedes, field-beet, or other roots. In their growing state, all animals require nourishment; and in mature age they repay the good feeding they had received in their early condition. Linseed-tea is not a bad beverage for calves. It may be prepared by boiling (for five or six hours) two pounds of linseed in four gallons of water: if five pounds of crushed barley and ten pounds of cut straw be soaked in this ptisan for an hour, they will make an excellent compound; to be given warm, and alternately with Swedes. Field-beet is the best of the root-class of vegetables, for a cow giving milk; and, if not steamed, it should be scalded with boiling water, then sprinkled with salt occasionally. If fresh Swedish turnips be the unavoidable substitute

cent. of water, and more than five of sand: the various salts, including the Glauber, were worth but £4 per ton, so that £5 per ton would have paid the compounder.—*See Blackie's Cyclopædia of Agriculture—on Saline Manure.*

for beet, they may be, it is said, divested of any unpleasant effects on the taste of milk, by scalding (but not boiling) this, as in Devonshire, viz., by placing the milk on the hot plate of a kitchen-range, when it has stood in the usual way in the pan, for twelve hours after it has been drawn from the cow. Turnips that have been long pulled will impart a strong flavour. The best preventive, however, of a disagreeable turnipy taste is, to avoid giving turnips to the cow, except immediately after milking; and therefore, before the new-milk secretions have advanced. Some persons put nitre instead of chloride of lime into the milk-pail before the milk is drawn, or add about half a pint of boiling water to every gallon of new milk, stirring together the two fluids a minute or two, and then putting the milk thus slightly diluted into the pan. Bran mashes are good for a cow giving milk, and not near calving.

As Swedish turnips preserve their freshness and succulence better in the ground than out of it, those portions required for the animal stock should be brought to the farm-yard only in such quantities as will supply the immediate demands, and provide for any contingent difficulty which may arise from extreme and sudden severity of weather, rendering access to the field difficult.

Perhaps you are fattening one or more cows which have reached the age of seven or eight years, and are no longer valuable for the dairy; if so, this is an important season for forwarding their condition. They ought to be now in the third month of their fattening course, and on full allowance. Their general treatment should be methodically exact. Early in the morning the foul litter should be cleared off and wheeled to the dung-pit; a few pounds of soft, sweet, and nutritive hay should be given to each cow, that ought to be curried and wisped, particularly about the hind quarters, to which dirt will adhere, notwithstanding the utmost cleanliness of management. Shampooing tends to circulate the blood and relieve the irritation, by which cattle in close confinement, and highly fed, are tortured. The old hair will fall off, and a new

growth succeed as flesh increases; and the slight trouble of grooming the poor animal, that enjoys a gentle scratching excessively, will be repaid by its improvement in condition and pleasing appearance. Even the milch-cow ought not to be neglected in this instance. A large beast, while fattening, will consume daily, two bushels of cut turnips; but alternating feeds of potatoes, carrots, or parsnips, with six pounds of oil-cake, are to be recommended. Barley-meal or bruised barley, soaked in boiling-water, with a small quantity of crushed linseed, mixed with chaff, is a good substitute for oil-cake. The first feed should be given early in the morning, and the last about six o'clock, when the fattening animals should be littered. Where oil-cake is given, fourteen pounds of hay will be sufficient fodder for the day and night. Three or four ounces of salt scattered over turnips, &c., tend to promote digestion and general good health. If the roots be given raw to the cattle, water will not be required by them.

FEBRUARY.

If you have adopted the very modern improvement on Jethro Tull's system of wheat-growing, suggested by the Rev. S. Smith,* of Lois Weedon, you should now level

* This great benefactor to his country has made known, in a pamphlet remarkable for its perspicuity, and entitled, "A Word in Season," his peculiar system of cultivating wheat. It is not a description of experimental management, but of full experience. Without any adventitious manures, but by merely bringing up the subsoil at regular intervals of gradually deepening spade-work, and mixing it with the surface clay or loam, the inorganic mineral elements of nourishment, phosphates, and alkalies, are supplied to the wheat, while the deep and perfect stirring of the whole mass renders it the free recipient of the ammonia which the atmosphere sufficiently supplies. Jethro Tull, who originated the drill-system, was only so far wise in his generation as to know the value of atmospheric influences on the loosened and fallow surface in supplying food to plants, but he knew not of the mine of alimentary substances contained in the subsoil clay. But our approval of the system must be qualified, for it can hardly be very desirable where labourers are few, and labour consequently dear; nor where facilities abound for employing putrescent manures; nor where farm-horses are of neces-

down the rough surface of the fallowed intervals between the drills which had been sown in autumn, with Parkes's five-tined fork, and stir the surface (previously dug deeply), but a few inches, if you intend to use a horse scarifier afterwards. Keep the fork or spade three inches from the wheat-plants, lest their roots should be disturbed; and if these should be exposed from the action of frost, press the earth to them closely when it is quite dry.

The feeding of the live-stock continues as before, and the occupations of the preceding month are still to be continued. Young cattle should get turnips very freely with their straw. Some farmers give from two to four pounds of oil-cake instead of turnips; and there are niggardly economists who persuade themselves that straw alone is sufficient for growing cattle. But animals thus half-starved look in spring as if they were even a degenerate offspring of Pharaoh's lean kine. The manure produced from them is of miserable quality (relatively), so that the saving of nutritious food to them is but "penny-wise" economy, in any point of view. The lambs purchased last autumn should now be fattening on turnips in the field; but if snow or any storms occur, they will require shelter. At the commencement of the month,

sity kept (as this is a spade-husbandry system); nor where the due supply of green crops is an important object; nor, lastly, on soils not decidedly adapted to wheat-growing, and more or less unfavourable to green crops from the preponderance of argyl in their composition. "We must not, then, rush to a conclusion in favour of the applicability of the system to land in general, from its success in this individual instance. Before such a result can be arrived at with any kind of confidence, trials must be made on lime-stones and on granites, as well as on clays and loams, and on light soils as well as on heavy ones. Until this has been done, it is impossible to predict, in any particular case, that a sufficient amount of ammonia can be absorbed by the soil, through the mere process of pulverization, to answer our purpose, and to provide materials for an abundant crop. Neither are we justified in assuming, that every kind of soil which we cultivate contains within itself a sufficient amount of phosphoric acid in that state of combination which allows it to become soluble and available for the purposes of plants."—*Dr. Daubeny.*

about half the winter supply of hay, straw, and roots should be unconsumed; therefore the probable excess or deficiency in these requisites can be estimated, and arrangements for the future made accordingly.

Your bacon-hogs should be advancing rapidly to their fat condition, and receiving the mixture of barley and pea-meal noticed in the chapter on swine.* Preparation for the bean-sowing will now, if the state of the weather permit, be the first spring work, and it may be also completed before the expiration of the month. But do not sow until the land is in a satisfactory state.

Turn composts, and lose no opportunity of amassing manure.

If you have a hedge to make, or trees to plant, you cannot have a better period of the year for such work. (See *Fences*.) Some experienced hedgers do not pursue the old method of heading the quicks at the time of planting them, but defer this operation until the ensuing spring, by which they think that the plants are invigorated. The intermixture of privet among the thorns has a pleasing effect in winter, and tends to afford some shelter to the sheep which seek the protection of a hedge from the wind. Hornbeam serves the purpose of filling up gaps in established hedges remarkably well, and it is a fit companion also for thorns in the first planting of a hedge.

MARCH.

The sowing of oats, as soon as the land is in a dry state for working, and of beans or peas, if not done in February, is to proceed during the whole course of this month—according to the circumstances of the soil, the weather, and the average climate. What may be late in one locality may be early in another; but, whatever be the approved time for *sowing* any of the spring crops, the preparation for them in ploughing and harrowing, scarifying and grubbing, cannot be too soon commenced —always supposing the soil to be in a fit state for

* One-third of bean or pea meal to two-thirds of barley-meal.

stirring it. Then vetches, parsnips, carrots, all present themselves as claiming to be sown, and experience has fully shown that the early-sown crops of those kinds are generally more weighty in their yield, and altogether more successful, than those of later sowing. The days are now long for working cattle, and their feeding should be augmented according to the increased demands upon their energies. Soils which are naturally rather too stiff for some of those crops, which it may be an object to cultivate, may be so pulverized by preparatory culture and judicious manuring as to produce them even more favourably than lighter soils negligently tilled. Carrots are an instance of this. Land that has been very deeply ploughed in winter, and is now loosened by the heavy harrow, may be rendered, though naturally stiff, quite fit for this nourishing vegetable. Horses to which fourteen or twenty pounds of carrots are at this season supplied, will, with a moderate allowance of oats, perform their work in a superior manner, and without losing their condition. Field-beet is another of the very valuable crops which may be raised even on soil of middling quality, provided it is not very thin. M. Dombasle assigned to it the first rank among the root crops for cattle, as he did to lucern among the artificial grasses, and during eight months of the year.

The preparation of the ground, and the manner of sowing or planting the different cereal, leguminous, and tuberous crops, have been detailed under their respective heads. Nothing remains to be suggested respecting these subjects.

A good sower, who can distribute the seed evenly and in just proportions, is an important personage just now. Much depends upon his skill. He will not, if he understands his business, sow seeds together that have not the same bulk and weight, or nearly so, else they will be unevenly scattered; nor will he on a windy day, sow any seeds of a light nature.

A sprinkling of 1 cwt. of nitrate of soda, mixed with 2 cwts. of salt, will now be an acceptable food to the

wheat plants, by whatever method sown. This stimulating and reviving compound should be scattered over the surface by an experienced hand.

The first sowing of spring vetches should be accomplished early in the month.

The first hoeing of wheat must now commence, and a second should follow at an interval of three weeks.

The roller should be kept in exercise about the end of the month, on wheat and grass fields.

APRIL.

A great deal of the work referred to in the last month will be in progress during the course of the present season. Baffling weather, among other causes, may have rendered it impracticable or injudicious to sow and plant freely during the last month. No valuable time or season has been actually lost, perhaps, by the delay. Precipitancy is as bad as procrastination in sowing and planting; and in many parts of the kingdom some of the routined labours which I have indicated as seasonable in March would be premature. There is the difference of a full month as to season between one county and another.

During this month stir deeply the fallowed intervals (on the Lois Weedon system) between the rows of wheat, with Newington's light subsoil plough with two tines, or any implement that will effectually loosen the soil to its full depth, without throwing any of it on the plants at either side.

Sow vetches for successions, every fortnight, if you apprehend a deficiency of other artificial grasses. All the grass tribe will be sown with best effect in the course of this month. On cold clay soil, it is sometimes useful to sow red clover and rye-grass through the wheat at this season, to intervene as a full crop between the wheat and oats. Give the second hand-hoeing to wheat, if not previously done. Though in England three experienced men will hoe an acre in the day, an inexpert hand will do but little. The French, who, like the Irish, hardly know anything about

it, speak of eight men being able to accomplish the same operation on broadcast-sown wheat.

Before turning fallow ground, it is judicious to let the annual weeds, or weeds whose seeds have been introduced in foul manure, germinate completely before they are turned in. If they be two or three inches high, so much the better. They will have exhausted their powers pretty nearly, and will not give much trouble again in the same season.

Harrowing old pastures and beans preparatory to hoeing, when the ground is quite dry, and rolling spring corn, when well up, should not be neglected. Cows should be fed with Swedes or mangolds, at least a month before calving; though an animal ought not to be in a fat condition before parturition, it should be in good order.

MAY.

The usual treatment of the various crops of the established rotations has been touched upon under the head of each. But our attention is to be turned anxiously to the details of the very modern methods by which moderate irrigation, with the liquids of the farm-yard, or town sewage, which has been happily designated as "a stream of liquid guano," produces, at least, four blades of grass where one had grown before, and supports four times the live stock previously maintained on the same extent of land. The widely known success of Mr. Kennedy, at Myremill, in Ayrshire, ought to stimulate our exertions, and, at least, make farmers *think*. Mr. Kennedy's system is to distribute the liquid through pipes *over* the surface, by steam-power. "He can increase his wet days," as Mr. Mechi says, "whenever he chooses;" and when other people's fields are parched with drought, his are glistening with perennial verdure. Having an unfailing supply of water, he can either mix it in his manure-tank with a more enriching substance, and so shower it over the land, or he can sow guano broadcast over the grass, and then wash it in dissolved; or, if

nothing but moisture is needed, he applies that only.* The cost of this system cannot be alarming to any independent man, and it has been found to give a great return of profit where tried on Italian rye-grass. For root-crops and artificial grasses also, another mode of treatment on a very minute scale of cultivation may be noticed here, and recommended in the strongest manner—the application of the liquid manure by *subterranean* pipes. By this management, which I have seen practised most successfully, on a very minute garden scale, by Mr. Wilkins, at Reading, the rich fluid is conveyed, by round or half-round drain pipes, directly to the roots of the plants, in any quantity required; and, of course, without that loss of ammonia, by evaporation, with which superficial irrigation must be followed, and that hardening or incrustation of the surface which so often results from artificial watering, in very dry or hot weather, when the operation is most needed.

His method is, after laying a level bed of concrete, flags, tiles, or flint stones, cemented with mortar under the surface, at the depth of from fourteen to eighteen inches, to lay parallel rows of semicircular drain tiles on this water-proof bottom (with a rim of bricks on edge, or tiles four and a half inches high, to prevent the liquid from escaping), unto which the fluid manure can be conveyed from a tank above, by a gutta percha tube, from which it is discharged through single pipes, placed vertically at one end of each row of the underground conductors. The earth having been laid to the full depth over these conductors, is moistened, or saturated with moisture, at the will of the cultivator. Mr. Wilkins has an ingenious contrivance also for ascertaining the depth to which the fluid rises from the bottom through the soil, by means of a second upright pipe, at the opposite end of the line of pipes from that into which the liquid is poured; by looking down into this, he sees the number of inches to which the liquid rises in it, and he estimates

* Correspondent of the "Times."

also the greater height to which it rises through the pores of the soil by capillary attraction. The produce of crops has been enormous: even from *mere sand*, potatoes grew rapidly, and of very fair yield. To ascertain results accurately, Mr. Wilkins left one side of the garden unpaved and unsupplied with the liquid manure, and in some instances I saw the soil barren, while the corresponding bed, treated according to his (now patented) system, bore luxuriant plants. Mr. Mechi has thus noted, from his personal view, in the "Agricultural Gazette," the distinctive results in a few particulars:—"One potato, planted in June, had bines five feet long, and numerous potatoes, one of which weighed two pounds, though the parent one was small and of a small stock. The corresponding one on the opposite bed was very inferior in product. The former had sent down a strong root to the neighbourhood of the subterranean pipes, and had there multiplied its fibres most abundantly. The carrot had gone directly down to the liquid, as straight as an arrow, while its competitor in the opposite bed was short and fanged. The most extraordinary result was its effect on turnip-seed, sown in September on the surface. The seeds all vegetated, and the plants were vigorous, on the *patent* side; on the other, a total failure, except one or two stunted and crippled plants."

The first outlay is the only debateable point, and this expense must be very great; yet to a rich man, who dearly enjoys the innocent gratification of husbandry, and can afford the cost of preparation, the ultimate result would be far more remunerative to him than the usual rates of interest on money. In a season of drought, his field would be like Gideon's fleece, full of moisture, when all would be dry upon the earth beside. To have at least an acre so treated would not impoverish many of my readers, even though it should cost £100.

The pasturing of milch cows now commences; or, if they be confined on the house-feeding system, green food will be sufficiently forward for cutting. Rye comes first, and of this but little should be given at first, as it is very

laxative. Vetches and lucern succeed; then clover, which for certainty, abundance, and adaptation to almost every soil, surpasses all other grasses.

The great want will probably be that of an abundant supply of straw, as on this will depend the full quantity of manure, which is the most remunerative item in the house-feeding system.

The grasses, when mown and consumed in their fresh state, will yield a much greater amount of food than if made into hay or depastured; in the latter case, the blades are prematurely nipped, in the other there is great waste by evaporation. One man can supply twenty head of cattle with green cut food in a day. Cows, from eating clover too greedily, before the fixed air has escaped, become so inflated that they sometimes burst, unless relieved by the probang, which should always be at hand for cattle thus "hoven," as it is termed. This instrument is put down the throat about two feet, and smartly tapped with the hand; the foul air then escapes. If there be no probang at the necessary moment, an incision must be made with a penknife in the right flank which will be in a state of tension like the parchment of a drum, unless the suffering animal be relieved by moving about gently for a few moments at a time. The instrument called a trocart is the proper one for piercing the flank. On the withdrawal of the point, the tube remains in the orifice, and allows the gas to issue forth.

Hoe deeply between the rows of wheat, however sown, and do not leave a weed standing. The intervals between the Lois Weedon drills should now be forked or scarified several inches deep. The first stirring, according to Mr. Smith's practice, should be of the width of twenty-eight inches; and as the wheat plants rise, the width moved by the fork must be gradually diminished to twenty-four and eighteen inches.

This will be a fit season for burning the subsoil of headlands, &c., if ashes be required for mixing with guano or any other manures, to allow of their equable distribution to turnip drills or other purposes, and also to supply

potash; but too much torrefaction of the clay would destroy its good quality as a manure. According to the opinions of some agricultural chemists, the solubility of its mineral ingredients is diminished by burning clay too much, and it is less capable of absorbing ammonia from the atmosphere; but by moderate heat, clay is rendered capable of giving out considerably more of its soluble inorganic substances.

Though the burning of clay is certainly not so necessary now as it was on the first introduction of the green-crop system, and when not only the methods of collecting large quantities of putrescent manures by house-feeding cattle, &c., but the now familiar use of artificial manures, containing much aliment for plants in a very small bulk, were almost unknown, the burning of clay in summer was found a very profitable practice. General Beatson, of the county of Sussex, used to apply his farm-yard dung to hops and a small breadth of potato land, and burn clay for his wheat. He asserted that his clay-ashes produced for him thirty-three per cent. more of wheat to the acre than his neighbours reaped, and such was his prejudice, that he gave burnt clay the preference over lime or farm-yard dung. One great cultivator of green crops has remarked, that in very dry seasons, farm-dung becomes so deprived by evaporation of its moisture as to be incapable of nourishing the roots of plants, whereas crops manured with burnt earth vegetate freely, in consequence of the power of absorbing from the atmosphere elements of food for the plants. If, then, circumstances render you perplexed in providing for due portions of better manures for the turnip-crops, which will now begin to call for your steady attention, you may find it expedient to burn the useless subsoil of a head-land, or any elevated portion of a field which you desire to level. But, undoubtedly, some of the powerful artificial manures should be mixed through the ashes so obtained.

JUNE AND JULY.

Early in June earth up the outer sides of the wheat rows (Lois Weedon practice) three or four inches, not for the mere purpose of strengthening the straw, which under this system is scarcely ever laid, but to prevent it from becoming twisted* in stormy weather, and to secure its uprightness. The sowing of Swedes commences early in June, and that of globes in July, in the midland counties. And it is fortunate that such late sowing answers best, as this circumstance renders it easily practicable to work the land into perfect tilth previously to sowing. If weather be unpropitious to hay-making, it will, at least, be favourable to the germination of the turnip-seed. In describing the culture of the turnip, it has been intimated that in order to stimulate its growth, and assist its energies in escaping the ravages of the fly, the seed should be put almost in contact with the manure. Practice has decided that this is right, and yet theory, it is but just to state, has been plausible against it. A late eminent chemical agriculturist has left this just observation on record: "We are generally told, and principally in the instances of drilled crops, to spread manures that are in a state of powder along with seeds; and implements have been invented to do this; but the practice is founded on erroneous principles. At the moment when the radicle issues from the grain, to sink into the earth, the young plant cannot draw any nourishment from the soil, but feeds entirely on the substances which nature has placed within the grain itself for the purpose. It is the fœtus in the mother's womb. The plant cannot extract nutrition from the soil, until it has acquired the power of respiration, by means of the developed leaves above the ground. But then the extremity of the radicle by which it seeks alimentary juices is already sunk below the point where the seed was laid. It is not then at that point

* A Word in Season.

that the manure should be applied. Some powdery substances destroy plants when first germinating, by touching the seeds. Generally manures in a state of very minute division act most effectively if spread broadcast on the surface, before or after sowing, for then rain dissolves them easily." M. Dombasle, from such considerations as these, deduces as an established principle, that it is needless, if not positively injurious, to steep seeds before sowing them, in any substances likely to promote their germination. He even objects to the steeping of seed in water previously to sowing it, for the purpose of hastening its germination, because if the earth be moist when the seed is sown, the germ will be quickly developed; but if the earth be dry, the already germinated seed will perish if the drought continues. The hand and horse hoeing of all the drilled green crops should be constantly attended to. Earth up your potatoes as long as a double mould board plough, or hand-hoe, as the case may be, can be introduced between the drills. The thinning of Swedes, beet, carrots, &c., should not be neglected, and weeds must be destroyed by every means. During these two months they are especially troublesome, appearing in various tribes, and at every point of attack. By removing them, and either burning or reducing them in the pig-yard to a state of rottenness and utility as manures, they may be rendered useful agents: by leaving them in the fields they occasion serious loss, while they also present an unsightly appearance. A remarkable proof of the destructiveness of weeds in corn-fields is given by the Bath and West of England Agricultural Society. Seven acres of land were sown broadcast—of these one acre was measured, and left unweeded for experiment, the other six were carefully weeded: the unweeded acre produced eighteen bushels of wheat; the six weeded, averaged twenty-two and a half bushels per acre. Again, six acres were sown with barley, and well prepared in every respect: the weeding (charlock abounding there) cost 12*s.* per acre. The produce of an unweeded acre was thirteen bushels, of the weeded twenty-eight bushels!—and besides this,

the land in the one case was in good order for the succeeding crop, and in the other in a bad state. But further, six acres were sown with oats,—one acre ploughed but once and unmanured, produced only seventeen bushels; the rest ploughed three times, manured and weeded, produced thirty-seven bushels per acre: of this increase, one half of the excess was attributed to careful weeding, the other half to the manuring—a good practical lesson in both results.

At leisure hours, hedges ought to be trimmed. The most expeditious manner of doing so, is by the use of a long-handled hook, if the hedge be high. Where great neatness is desired, as in the case of ornamental hedges, clipping with shears is preferable, though more tedious. Sporting farmers, who preserve game, will postpone either operation until the end of this month, when partridges and pheasants, so frequently in hedges, shall have left their nests.

AUGUST.

The busy work of harvest is now to be performed, and a farmer should take every advantage of favourable weather to gather in his corn, never postponing until to-morrow what might be done to-day, nor trusting to weather in any degree, but always executing his labours as if he expected a deluge of rain next day. He should seize upon every favourable moment to do his work. Yet he must wait until his grain is ripe, and experience alone will enable him to know when the critical degree of ripeness has been attained. If wheat and oats (barley can stand much longer without loss) become over ripe, the best grains fall to the ground after every blast of wind and shower of rain; and further loss is sustained in binding, stooking, and stacking, or in the turning of windrows. The usual criterion of ripeness is the yellowness and dryness of the straw immediately below the ear: the grains should be tender enough to yield to the nail, and firm enough not to be cut through by it. Wheat grains

would shrivel if prematurely cut; barley would be deficient in colour and plumpness under the same condition; but oats, generally, should be severed before the straw is quite sapless, else a great deal of its grain will be lost; and it will ripen in the course of a week on the ground, without suffering injury from showers. The mode of reaping wheat, called fagging, is very general in England—as it is also in the north of France—and is thus executed: the left leg being pushed into the standing corn, the straw is then inclined with the left hand over the left foot, and cut close to the ground with a stroke from the right hand. An active and fully experienced labourer will fag half an acre a day in this way. If, however, the straw is lodged and entangled, the sickle is the proper instrument for reaping it. Barley and oats are almost universally mown in the parts of England best known to me, and laid and turned like grass in windrows, until dry enough to be ricked. On a very small scale of cultivation the sickle will probably appear on trial more convenient, if not more economical, than mowing, on account of the neatness and regularity of corn in sheaf, and the facility of thrashing it out by the flail, when regularly bound, with the ears together. On uneven ground, among obstacles of any kind, and where the straw is lodged or matted, the sickle is the proper implement.

The performance of so important a work as that of cutting and harvesting corn must be in some measure regulated by local practice and the methods familiar to the labourers. Though, for example, an expert man accustomed to mow wheat with the scythe may be unhesitatingly entrusted with this work, under favouring circumstances of climate and evenness of surface, the farmer would act absurdly who should say to an ordinary mower of grass, "Go and mow my wheat in the same manner," or to the labourer accustomed only to the use of the reaping-hook, "You must fag this wheat." No one of the practices is so pre-eminently superior to another as to render prudent the abandonment of the

local method with which the workmen are familiar, and in which they have acquired dexterity. Mowing wheat, though so common in Hampshire, from the paucity of hands and the high rates of labour in harvest, and perhaps more especially from the usual steadiness of the weather in August, must be a very hazardous method in districts less favoured in respect of climate. The advantage of harvesting the wheat in sheaves of convenient size, that may be stooked and capped immediately after the sickle or hook, and left in this state, which secures it against any ordinary bad weather, is not to be lightly dispensed with. When continued rain is dreaded, and the grain is yet unfit for stacking, or taking to the barn, sheaves can be conveniently placed in miniature stacks of cone form, in which position they will defy rain, even of many days' continuance. If the sheaves of wheat, when quite seasoned, be not stored in a barn, care should be taken to have suitable corn-stands. Those made of cast metal, moveable, and vermin-proof, are neat, and serviceable for every sort of cereal grain, as also for pease and beans and can be bought of any dimensions.

Thatch the stacks neatly as soon as possible. If wheat stubbles be sufficiently clean and in good tilth, and the harvest very early, *trifolium incarnatum* may be sown on a portion of them, after a light ploughing or thorough scarifying. It should be sown early in the month, to be well rooted before frost comes; and if the clover seed sown in spring has failed in patches, *trifolium incarnatum* should be now sown (raked in) there, to fill up the vacant spots. This species of clover, however, yields but one cutting, and therefore is not worthy to displace the common red clover, which affords two heavy cuttings (if properly treated), and each of more nutritiveness than the other sort. As an intercalary crop, indeed, this much newer variety is very valuable, as it ripens earlier than the other, and may be removed in time for turnip-sowing in the usual season. Neither this, however, nor any other crop can be frequently introduced thus irregularly in a rotation, because, though the ground may be

conveniently renovated by increased manuring, for its over work in supporting two crops instead of one within the year, it will have lost the advantage of a perfect winter fallowing and the cleaning which accompanies this. In the instance of turnips sown on stubbles, the land may be well fallowed after they have been fed off, and long before Christmas; and little derangement of routine work will be occasioned by their intervention, though out of regular course. If neither of these intercalary crops, nor rape, nor rye, for early fodder, is to be introduced, the wheat stubbles should have their winter ploughing, as soon as pigs and poultry have picked up the scattered grains of corn.

Beans are ripe when the stalks and pods become black; they should be cut with the sickle, not pulled up by the roots, as some very slovenly cultivators do; having neglected to hoe out weeds during the summer, they take this method of extracting some of their roots along with those of the beans which they have been so long robbing of their full nourishment. The pulling, indeed, of the haulms is not objectionable, if they are intended only for fuel or litter, but true economy requires that they should be chopped and given for food to horses and cattle, according to Scotch practice, by which the coarse parts are given to horses in spring, as part of their fodder, and the more tender parts are steamed for cows, and mixed with bran or some such substance. By pulling the stalks out by the roots they are harvested in a dirty manner, which renders them unsuitable as fodder.

The crop should be fagged like wheat, bound in sheaves, and stooked for some time, and then carried and stacked, or put into a barn. Plough the bean stubbles deeply, and without needless delay. Any portion of land from which pease have been carried will be in capital preparation for wheat.

Feed milch cows and pigs with the leaves of field-beet which begin to droop, and thereby indicate that they are no longer serviceable to the plant. They will be eaten with avidity, if in no degree decayed. Do not allow the

leafy parts of any vegetables to wither on the ground; while they are in an eatable state convey them to the pig-sties, if they be unfit for or unnecessary to cows.

Scarify the *intervals* between the (Lois Weedon) stubble rows, to encourage the germination of the grains self-sown after reaping; when they have sprung up, destroy them by another scarifying, which will leave the ground perfectly clean for the regular sowing next month.

To obtain the soundest and heaviest grains without bruising them, put a ladder or thick board across the barn floor, and let a labourer gently strike the corn end of the sheaves, which should be so reduced in size for the temporary purpose as to be held easily in his doubled fists, and gently struck against the wooden bar. This in Ireland is called *slashing* out the grain, and if merely for obtaining the choicest grains for seed, it is so gently performed, that the best grains only drop out. A woman attends to rebind the sheaves, which are afterwards thrashed in the common way.

SEPTEMBER.

Saving Clover-seed.—The economical Belgians take the trouble of culling the ripe heads of the clover which has seeded in the second growth (the first crop having been mown early, and before the seed had ripened), and taking them in bags to the barn. And this is a particularly judicious practice in small farming, in an unfavourable season: these heads can be dried under cover, while the full clover crop is being mown for soiling, or hay, as circumstances may require. The seed can be thrashed out at leisure, and without much labour, if it has been perfectly dried in the sun.

The Lifting of Potatoes.—The main crop, or late kinds, ought not to be taken out of the ground before the end of the month. If the quantity be inconsiderable, the simplest mode of lifting them is to fork them out with a three-pronged fork, each prong being five or six inches long, and flattened at the extremities, and close enough

to prevent a potato from escaping between them. A spade frequently cuts the tubers. If there be so much as two or three acres of potatoes, the most expeditious mode of clearing them out (but the late sorts should not be yet lifted, at least, not before the end of this month) is with the plough, in this way:—the cross drills on the headlands (if bearing potatoes also) being first cleared with forks, the labourers pull away the withered stalks and remove them, and some pickers with little baskets follow them to collect any tubers that may have been pulled out of the ground with the stalks, and drop them into carts placed at convenient distances. A double mould board-plough, with a very long and narrow sole, and without the coulter, is then drawn to the scene of action by a pair of strong horses, by which it is pulled through each drill, the sole passing along about two inches under the level of the tubers, splitting the drill open, and with the mould-boards throwing the potatoes cleanly out to the right and left. The labourers, with the sprongs just described, collect them on the surface, which they level at the same time; and the pickers gather them in baskets, which they empty into the nearest carts. By harrowing the ground afterwards, stray potatoes will be brought to the surface, from which, of course, they should be removed; and if the ground be not perfectly freed from them, a light ploughing to turn up and expose the buried stragglers, with a picker following in the furrows to collect them, will be necessary. Without such care, the growth of the potatoes left in the earth would be embarrassing to the corn crop, and present a slovenly appearance. A single plough can clear out from one and a half to two acres of drills in a day, if there be ten forkers and as many pickers attending it. Where a plough with double mould-board is not at hand, a common swing plough can execute the work very well, by first taking a narrow furrow-slice from each side of the drill, and then turning over the centre, the pickers following closely. In this operation, three boutings will be necessary; but if the centre part of the drill, which contains the great bulk of the crop, be forked,

two boutings will suffice. The second is the neater mode. If the ground be in a clammy state, the plough should not be used at all.

If an empty outhouse can be spared for storing the potatoes, they should be laid on the floor, but not in too thick a mass, lest heating and premature germination should be the consequence. Potatoes cannot be kept in a more fresh and healthy condition than by leaving them during the winter in the land, provided it be perfectly porous and dry, and that a very heavy covering of sedge, reeds, or any such material, be laid over the undug crop. No heating, no rotting can ensue with such management.

But, generally, potatoes are heaped up in a sharp ridge form, in what is called a *pit*, though this is but a few inches deep—a shallow bed about four feet in breadth, and of convenient length; they are covered up, when raised to a sufficient height, with earth, beaten closely with spades, and so inclined at the sides and ends that none of them can slip down. The potato haulm should not be laid between the potatoes and the crust of earth, as it soon becomes mouldy, and tends to rot the potatoes in contact with it; nor is even dry straw useful for enveloping the potatoes.

Rye may now be sown on ploughed wheat stubbles, in a small degree, for the first spring green food, either for a milch cow or for sheep. The seed should be sown early in this month, that the plants may be vigorous before the frost affects them. This is one of the intercalary crops which may be occasionally introduced with convenience, and without derangement of the rotation. Sow it thickly, at the rate of three and a-half bushels to the acre.

The preparation of clover-leys for wheat, as to manuring and ploughing.—(See *Wheat Culture*, p. 33.)

If vetches be wanted, part of the wheat and stubble land should be prepared for them; the first sowing may commence at the end of this month. It is important to have them early in spring, to succeed the Swedish *turnips as food*, which may then be very limited in sup-

ply. The best way of sowing vetches with rye or oats is in the proportion of two bushels and a-half of vetches to half a bushel of rye, or three-fourths of a bushel of oats, sowing the corn in the furrow and drilling the vetches across, which seeds the land with regularity. Cattle and horses prefer oats to rye, intermixed with vetches, but rye affords to the vetches stronger support, is more certain of withstanding winter frosts, and is a better protector from the white frosts of spring.

Fork out from the stubbles any couch grass that may infest them.

If you have not at the commencement of this month sown on the Rev. Mr. Smith's plan, but intend to adopt it, do it now in this manner; viz., sow your wheat in the centre of each fallowed interval, in two drills twelve inches apart, either with a double-drill machine or a dibble, at the distances previously stated. If early in the month sow lightly.

OCTOBER.

This is preferable to the last month for lifting the potato crop. Wheat-sowing ought to be completed within the month. The covering of the grain is not an immaterial point, for though it will germinate, and even root, if only shaded by earth from the light, it will be apt to fail if deposited less than four inches deep in light land and three in clay, to prevent the injurious action of frost on its roots, and to preserve it from birds. Professor Sprengel informs us that potash stiffens the straw, and consequently gives it a power of resisting mildew or rust—a plague of the wheat crop so long ago as the time of Moses. The *fungi** attack the straw under certain conditions, or quick transitions of temperature in the air, such as great heat after moist weather.

* The ancients called these parasites "children of the earth:' they appear to be also "children of the mist," coming with blighting vapours, and seizing on the stems and leaves of plants, and with their myriads of animalculæ tainting and devouring them.

Among the supposed preventives, potash may be one; this should, however, have been applied in spring.

Salt is confidently recommended by others, who scatter it over the land, at the rate of six bushels to the acre, immediately after sowing the seed. Solutions of various kinds are used to guard against smut, the cause of which is a mystery, which naturalists, refuting and opposing each other, have only mystified the more. It produces a diseased state of the flower organs, and the result is, the peduncle becomes a black ball of powdery substance.

Many farmers soak the seed in a strong salt-pickle, skimming off the floating grains, and drying the heavy side afterwards with fresh slacked quick-lime. Others use this solution:—Five pounds of blue vitriol (sulphate of copper), in five gallons of boiling water. Thirty gallons of cold soft water are afterwards added to the first solution, in a tub; the seed is put into a basket, and dipped for a minute in the liquid, then drained, and spread upon the floor to dry.

The practice of pickling, or washing wheat is not to be despised, but it is by no means a sure preventive of disease and decay. Certain soils and aspects are apt to produce morbific tendencies, which no treatment of the *seed* can effectually obviate.

The white Belgian carrot, or any sort you have, the cow-parsnip, and field-beet, should all be lifted early in the month, if it has not been done in September, and then earthed up in mounds, as in the case of potatoes. Carrots will require particular care, for they are more delicate than the others, more apt to ferment, and therefore they should not be piled up in large bulk. The leaves should be cut off to the crowns, but not so closely as to let them bleed, and the roots ought to be left on the ground a few hours to dry before being removed to the heap.

I take it for granted that the wheat stubble, not to be succeeded by any of the intercalary crops, has been before the middle of this month properly ploughed. Clay soils should be, more than others, ploughed while they are in *a state* in which the work may be done with satisfaction.

Until this time, lucern, vetches, and leaves of field-beet and clover, have supplied successions of cuttings for cattle and horses confined to the stables, but now these supplies have ceased, and hay, straw, and roots are to be the rations. (See *Horses, Cattle, and Swine.*) In estimating their relative degrees of nutritiousness, the experience of M. Dombasle is entitled to great respect. He gives precedence to potatoes and field-beet among the root crops, which he thinks are equivalent to a little less than half their weight of dry hay. Carrots he pronounces to be more healthful but less nutritive to cattle, and turnips to be, compared with hay, four-fifths less nutritive. And if you have varieties of roots, and cattle fattening upon them, vary the feeding; the more that a beast eats, if it have appetite and digests the food, the sooner will it repay for its keeping. Having turnips and potatoes, or field-beet and potatoes, these can be alternately given, and the animal will be able to consume in the day from seventy to eighty pounds or more, though it would not eat so much of any single sort if limited to the sole use of it. If your stock of hay be very limited, it will be prudent to feed horses a good deal on fresh-thrashed oat or wheat straw, in chaff, and to reserve the hay with carrots and oats, and a little beans, as much as can be for the spring time, when heavy work will be required; they can certainly dispense, more easily than a groom or coachman will admit, with hay, unless in very small portions.

The store pigs will require pollard in some proportion with their steamed roots; and those that are put up to fatten at the end of the month, when potatoes may be available to them, with Swedes, &c., should get some barley-meal or pea-meal, in the consistency of paste. If a pig be fattened upon potatoes and barley-meal alone, two bushels of potatoes and one peck and a quarter of barley-meal per week will be enough for it. Buttermilk and wash from the kitchen will be great auxiliaries to the dry diet. The lambs, that I have assumed you have purchased, will now feed on turnips, beginning with the globes.

NOVEMBER AND DECEMBER.

Wheat-sowing, if delayed from any causes, may be successfully executed in the early part of November. Increase the allowance of seed, as the season of sowing is postponed, but using less than two bushels and a-half on *light* lands. It is to be remembered that on strong lands less seed answers, because the plants tiller in such ground more freely. Some little increase in the quantity of seed will now be required where the practice is to give but a scanty amount. Many farmers over-seed their ground at all times, and to them it is needless to urge the propriety of increasing the proportion now; well would it be for many of them if one-third of their seed perished every season,—the crop would be much better.

Draining (See *Draining*), keeping the outlets of drains free, and furrowing the fallows, should be attended to.

Supply fattening cattle with Swedes regularly, and give pea-meal at the rate of half a bushel a week to a large beast, with good hay too; oil-cake, of course, is one of the abominations which it must swallow. When the white frosts come on, the lambs should have a little hay.

Cut down any hedges that require to be so treated, and clean out the ditches, plashing and repairing, where necessary, underwood and copses.

FINIS.

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